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FEDERAL AID IN FISH RESTORATION

Job Performance Report

Project F-71-R-11

REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS

Job No. 6 (IF)-c^2. Region 6 (Idaho Falls) Rivers and Streams Investigations - Big Lost River Survey

By

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State of: Idaho

Title: Region 6 (Idaho Falls) Rivers and Streams Investigations - Big Lost River Survey

Project No.: F-71-R-11

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Period covered: July 1, 1986 to June 30, 1987

ABSTRACT

The fishery of the upper Big Lost River drainage was assessed in 1986 to obtain information on wild fish populations, evaluate the return of hatchery fish to the creel, estimate catch and harvest, and assess habitat parameters.

Brook trout populations are for the most part confined to the upper reaches of the drainage. Most brook trout mature at two to three years of age when they reach lengths of 120 mm to 180 mm. Because of their small size at maturity, many brook trout spawn prior to becoming susceptible to angler harvest and populations are capable of withstanding high angler pressure. Few brook trout larger than 250 mm were observed but fish occasionally reach sizes of 450 mm. Brook trout densities ranged from 0 per 100 m^2 at several sites to 55 per 100 m^2 in Summit Creek. Other streams with high densities of brook trout include Cabin Creek and the upper East Fork.

Rainbow trout are found throughout the drainage and are the most abundant trout species in the lower part of the watershed. They are also found in high numbers in spring fed tributaries to the East Fork where resident populations have developed. Tributary populations are primarily made up of fish which mature at 165 mm to 250 mm. Mainstem fish typically do not mature until they reach sizes of 250 mm to 300 mm. Population sampling from mainstem reaches indicates that wild rainbow trout are experiencing high mortality prior to spawning and that densities are low. Angler harvest of juvenile fish is believed to be impacting wild rainbow populations. Rainbow trout in the mainstems are capable of reaching sizes of 500 mm or more.

Whitefish distribution is almost entirely confined to mainstem reaches of the upper Big Lost with occasional specimens being found in tributaries. Whitefish densities ranged from 2.5 fish to 8.0 fish per 100 m^2 in mainstem reaches.

Return-to-the-creel of hatchery fish, based on creel census estimates of harvest, ranged from 5% on Lake Creek to 44% on the North Fork. Overall, the return rate was 30X. With the exception of Wildhorse Creek (34% returns), hatchery returns from tributaries were typically low. An estimated 35% of the fish stocked in Kane Creek were returned, but most were caught either in Summit Creek or the North Fork. The total number of catchables stocked in the upper Big Lost should be reduced and confined to areas with high returns.

Anglers fished an estimated 29,133 hours on censused sections of the upper Big Lost drainage during 1986. Catch rates ranged from 0.62 trout per hour on Wildhorse Creek to 2.37 trout per hour on the upper East Fork and Starhope Creek. Overall catch rate for the drainage was 1.33 trout per hour. Whitefish contributed slightly to the fishery (catch rate of 0.05 fish per hour). Residents from over 20 counties made up 85% of the anglers fishing. Anglers from 15 states other than Idaho comprised the remainder of the angling population. The average angler fished 2.74 hours per day and creeled 1.5 trout. Most anglers (59%) used bait, followed by flies (30%) and lures (11%). Most anglers (74%) rated the fishing good or excellent.

Habitat in the upper Big Lost drainage is mostly in good condition. Cattle grazing has impacted parts of the East Fork and severely damaged most of Twin Bridges Creek. Wildhorse Creek has limited habitat in some reaches due to severe flooding. Beaver ponds are providing excellent habitat for brook trout, and where they are located on spring seeps, provide habitat that would otherwise not exist.

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INTRODUCTION

The Idaho Fish and Game Department's current Five-Year Fisheries Management Plan states that "little useful information exists for angler use and harvest or fish populations and distribution for streams of the Sinks drainages." Data for the upper Big Lost River fishery has been limited to occasional creel checks, limited electrofishing conducted by Forest Service personnel, and conductivity checks made by Idaho State University in Wildhorse Creek {Fuller 1981). Currently, the fishery is managed as a wild trout fishery with supplemental put-and-take stocking. No previous information on return-to-the-creel of hatchery fish is available.

In 1986, we initiated a study of the upper Big Lost River fishery. The purpose of the study was to obtain baseline data on the fishery which could be used to develop a sound management program. Specific objectives of the project are to:

1. Inventory fish populations in the Big Lost River upstream from Mackay Reservoir to assess fish densities and species composition.

2. Assess life history aspects of wild trout, including age structure, growth rates, size at maturity, movement patterns, and mortality rates.

3. Monitor the sport fishery to assess angler utilization, including effort expended, spatial and temporal distribution of effort, catch and harvest rates, and species composition in the creel. Also assess angler profiles and attitudes.

4. Evaluate the catchable trout stocking program, determine return to creel, and develop a stocking plan by subdrainage.

5. Identify habitat areas critical to certain life stages.

6. Identify habitat areas which are degraded and could be improved.

STUDY SITE DESCRIPTION

The Big Lost River drainage is located in central Idaho, originating in the Copper Basin area and eventually flowing southward to the sinks on the Idaho National Engineering Laboratory site. We concentrated our efforts in 1986 on that portion of the drainage upstream from Mackay Reservoir (Figure 1). Total area of the upper Big Lost drainage is approximately 2,000 km^2. much of which is high desert basin and rugged mountains. Elevation of that portion of the drainage ranges from 3,857 m at the peak of Mt. Borah to 1,847 m at Mackay Reservoir. Climatic conditions in the watershed are relatively dry, with an average annual precipitation of about 25 cm (Jensen 1982). Approximately 40% of the precipitation occurs as snow. Air temperatures in the drainage commonly drop to -35°C in the winter,

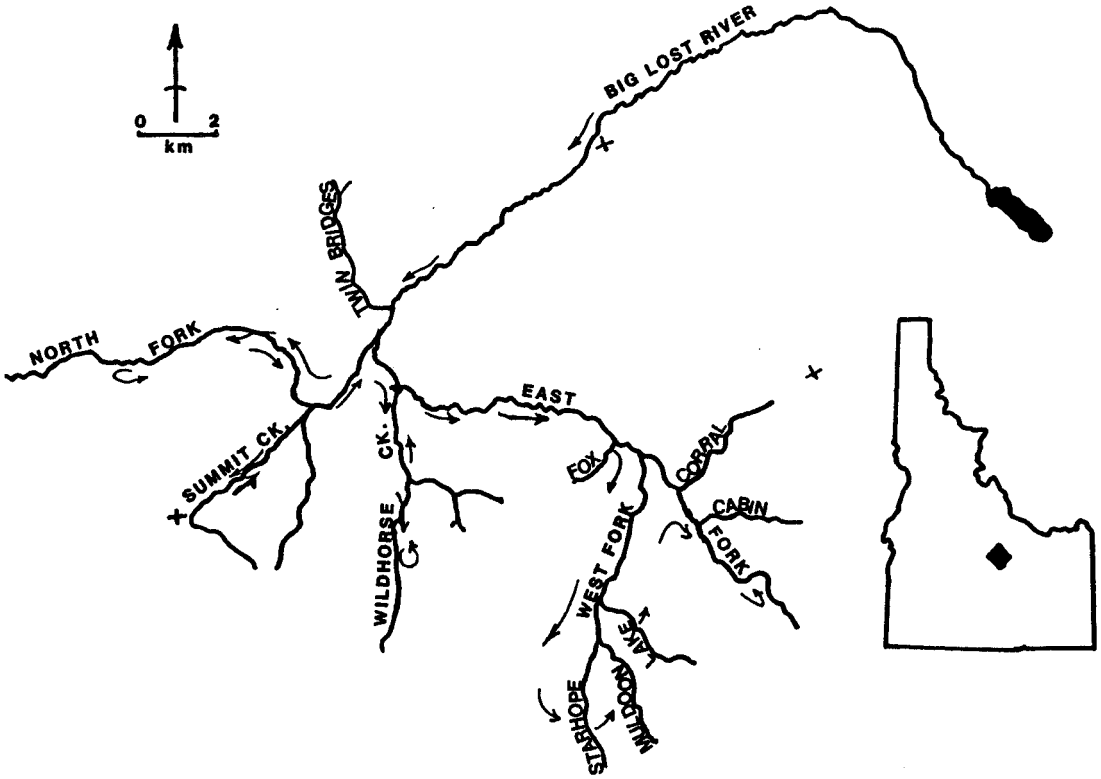

Figure 1. Map of the Upper Big Lost drainage. Arrows depict creel census route, X's depict check station locations.

and occasionally exceed 32°C in the summer. Stream temperatures reach 0°C in winter and warm to about 11°C in summer. An earlier study in Wildhorse Creek (Fuller 1981) found that stream conductivities reached 63 mhos/cm, indicating relatively infertile conditions.

The geology of the watershed is comprised largely of sedimentary rock, glacial deposits, alluvial deposits, and volcanics. Stream gradients in the areas sampled ranged from low (<1%) to steep (>5%) (Appendix 1). Low gradient stream sections typically follow a meandering course through wet meadow areas. Higher gradient stream reaches are characterized by large boulders creating small pools and pocket water. Drop structures and boulder structures have been placed in limited sections of tributaries by U.S. Forest Service personnel (Wayne Somes, Challis National Forest, personal communication) in order to create additional habitat.

Because of the high scenic quality of the area, its numerous recreational opportunities, and its proximity to the resort area of Sun Valley, the upper Big Lost drainage receives a considerable amount of recreational use. Fishing is one of the most popular recreational activities in the area.

Fish species present in the drainage include rainbow trout Salmo gairdneri, brook trout Salvelinus fontinalis, mountain whitefish Prosopium williamsoni, and sculpins Cottus spp. Introduced populations of cutthroat trout Salmo clarki, grayling Thymallus arcticus, and golden trout Salmo aguabonita inhabit several of the high lakes in the drainage, and individuals may occasionally drift down into the streams.

A high degree of uncertainty exists as to what the native fishes of the drainage are. Brook trout, grayling, and golden trout are all obviously the result of hatchery introductions, but other species may or may not be native. Hubbs and Miller (1948) believed that the fishes of the Lost River streams were representative of the Columbia River fauna rather than the upper Snake River.. They cited as evidence the presence of cutthroat trout, Dolly Varden (bull trout) Salvelinus confluentus, and a species of sculpin later described as the shorthead sculpin Cottus confusus. Behnke (1979) used this evidence to support his theory that headwater transfers from the Salmon River drainage resulted in population of the lava plains' streams by species of the Salmon River drainage. If this is the case, it is quite possible that rainbow trout are also native to the drainage, although almost continual stocking of the species since 1915 would make determination of this all but impossible. Simpson and Wallace (1978) depict Lost River rainbow populations as being introduced. Two other species, the mountain whitefish and the Piute sculpin C. beldingi, are present in both the upper Snake and Columbia River faunas, and their presence does little to clarify the situation. Viable bull trout and cutthroat trout populations are no longer evident, further reducing the evidence. The presence of sculpins and whitefish does, however, indicate that the drainage was not barren prior to the arrival of white men.

Techniques

Electrofishing, angling, and trap-netting techniques were used to capture fish during the study. For captured game fish, number and species in a sample were recorded. Population estimates were conducted where appropriate. Total lengths were recorded for all but a small number of the game fish captured. A portion of the fish were weighed, tagged, and had scale samples removed. Where possible, the sex and stage of maturity of adult fish was determined. Angler surveys were used to obtain information on the sport fishery with respect to effort, catch and harvest, and angler distribution. We used both regular and reward tags to evaluate returns of hatchery fish.

Electrofishing

We used three different types of electrofishing gear to capture fish during this project: 1) a generator powered Coffelt BP-1 backpack unit; 2) a drift boat mounted Coffelt VVP20 powered by a Homelite 3500 watt generator; and 3) a canoe mounted Pow'r Gard 1750 watt generator with a built in pulsed DC unit. All three methods utilized a fixed negative electrode and a mobile positive electrode.

Stream size dictated the type of gear used in our electrofishing sections. On tributary sections, we used the backpack shocker. Main stem areas were electrofished using either of the boat-mounted systems.

Angling

Angling was used to capture fish from large beaver ponds which we were unable to sample with other methods. Artificial flies and lures were used to minimize harm to captured fish.

Trap-Netting

We attempted to use trap-netting to sample fish in beaver ponds. We were unable to effectively capture fish with trap nets and discontinued their use.

Population Estimates

We used fish captured by electrofishing to make population estimates by one of three methods: 1) the Petersen single mark-recapture method (Everhart et al 1976), 2) the two-pass method of Seber and LeCren (1967), or 3) the maximum likelihood method developed by Zippin (1958).

When using the mark-recapture method, recapture runs were typically made five to seven days after the mark run. Removal estimates were made when an adequate number of fish could be collected to meet the assumption of the estimates. Confidence intervals were calculated at the 95% level.

Fish Movement

We assessed fish movement in the drainage using jaw-tagged fish released at the point of capture. Jaw tags were individually numbered to permit determination of each fish's net movement between captures. Recoveries of tagged fish were made by project personnel on subsequent angling trips or by anglers alerted to the presence of tagged fish by signs posted around the drainage.

Age and Growth

Scales were removed from wild fish from an area slightly posterior to the dorsal fin and above the lateral line. They were later dry-mounted between microscope slides and read with the aid of a Ken-A-Vision microprojector at 90x magnification. Interpretations were done using the criteria of Lagler (1956) and Royce (1972).

Mortality

Total instantaneous mortality (Z) was calculated for brook and rainbow trout in specific areas by constructing catch curves. As described by Ricker, the negative natural log of the slope between two points on a catch curve is equal to the total instantaneous mortality for that year class. Values for annual mortality (A) and annual survival (S) were determined from Ricker's (1975) table of exponential functions and derivatives.

Evaluation of Return to Creel by Hatchery Fish - Reward Tag Method

In order to obtain an estimate of the return to the creel by hatchery fish, we used a reward tag system. Results were compared to the return estimated from the angler surveys described below.

We tagged and released 3,176 hatchery rainbow trout from Mackay Hatchery into the upper Big Lost River tributaries. Fish were distributed in each planting area in proportion to untagged fish. Three hundred and nine of the tagged fish were tagged with gold-colored reward tags worth $5 to anglers reporting them. Signs posted around the drainage alerted anglers to the presence of tagged fish and provided instructions for reporting information. Tag return receptacles were placed at businesses in the Sun Valley area and Mackay area to further facilitate returns.

We assumed a 100% reporting rate on reward tags and corrected our reporting rate for non-reward tags based on the return of reward tags.

Angler Surveys

Angler counts were conducted through 13 two-week intervals beginning with the opening of fishing season (May 24) and ending November 21. Through the first eight intervals, counts were conducted on one randomly selected weekday and one randomly selected weekend day for each week of a two-week interval. After September 12, counts were made on one randomly selected weekday and weekend day per two-week

interval. Holidays were treated as weekend days. A count consisted of driving a census route (Figure 1) which began either on the Trail Creek road and finished on the upper East Fork road, or vice versa. Starting locations were alternated to avoid bias. The census route was divided into nine sections to assess angler distribution. Two counts were made each count day. Because anglers are often difficult to spot from the road, vehicles were counted instead of anglers. Because vehicle counts can overestimate effort, we adjusted our estimates downward by 1.61 (Moore et al. 1983). The following formulae were used to estimate effort:

$$Hc = a * V/C * d$$
$$H_{wb} - H_c * N_{we}$$
$$H_{wd} = He * N_{wd}$$
$$H_i = H_{wd} + H_{we}$$
$$H_a = H_i/1.61$$

Where: H_c = estimated number of hours per day, by day type
a = mean number of anglers per vehicle, as determined from angler interviews
V = number of vehicles counted
C = number of counts
d = mean number of daylight hours per day for the interval
H_{we} = total estimated hours for weekend days
N_{we} = number of weekend days in an interval
H_{wd} = total estimated hours for weekdays
N_{wd} = number of weekdays in an interval
H_i = total estimated hours for an interval
1.61 = conversion factor from Moore et al (1983)

Angler interviews were conducted on the stream bank when possible and at check stations. Check stations were run for approximately eight hours on Sundays at one of the three major access roads to the area (Figure 1). We used angler interviews to obtain information on number of anglers per vehicle, angler residence, number of hours fished, number of fish harvested and released (by species), and gear type used. We also asked anglers the following questions to help assess their attitudes towards the fishery:

1. How do you rate the fishing in the upper Big Lost River drainage?

2. Has fishing in the upper Big Lost River drainage: Improved? Declined? Stayed the same? No opinion?

3. Do you prefer to catch wild trout? Hatchery trout?Do not care which?

4. If you prefer wild trout, would you support special regulations to improve wild trout populations? Yes or No?

Anglers were interviewed as often as possible on non-check station days. Mean catch rate was determined for each species for each section and multiplied by estimated effort in an interval to give estimated harvest and catch.

FINDINGS

Distribution and Abundance

A variety of factors combine to influence the distribution and abundance of salmonids in streams of the upper Big Lost River drainage. Generally, rainbow trout and whitefish are found in lower elevation reaches, with brook trout occupying smaller streams in headwater areas (Appendix 1). This relationship breaks down for rainbow and brook trout in spring-fed areas.

In tributaries where fish mature at small sizes, self-sustaining populations of brook trout are found despite intense angling pressure. Rainbow maturing at larger sizes in the main stem are more susceptible to angling pressure. The following information represents the most significant findings in our assessment of the distribution and abundance of salmonids in the drainage.

Main Stem Big Lost River

We attempted to conduct a population estimate on a 1.5 km reach of the Big Lost River between Harry Canyon and Bady Creek Bridge on October 29. On the mark run, we captured 285 whitefish and 9 wild rainbow trout and hatchery rainbow trout. Because so few trout were marked, no attempt was made to complete the estimate.

All but eight of the whitefish captured were sexually mature adults ranging from 273 mm to 420 mm total length. Sixty percent of the mature fish captured were males. Juvenile whitefish ranged from 96 mm to 295 mm in length.

Wild rainbow trout captured ranged from 115 mm to 401 mm in length. The two largest fish (395 mm and 401 mm) were mature fish with the remainder being juveniles. Several trout were observed escaping the electrical field, indicating that galvanotaxis was poor and that the low capture rate may not be reflective of densities.

North Fork Big Lost River - Mouth to Summit Creek

We conducted a mark-recapture estimate on that section of the North Fork between the Challis National Forest boundary and the Trail Creek Road Bridge. The estimated density of trout was 6.4 trout/100 m^2 ($4.6 \leq N \leq 9.6$, 95% CI). Fifty-three percent of these were rainbow trout of hatchery origin, leaving the density of wild trout at 3.0/100 m^2. Rainbow trout comprised 88% of the wild fish captured, with brook trout making up the remainder. Whitefish density was calculated at 3.0 fish/100 m^2 ($2.4 < N < 4.1$, 95% CI).

The largest rainbow trout captured was 250 mm total length, with most of the fish measuring less than 150 mm (Figure 2). One brook trout fry was captured, with larger brook trout ranging from 115 mm to 205 mm. All of the whitefish captured were between 270 mm and 420 mm.

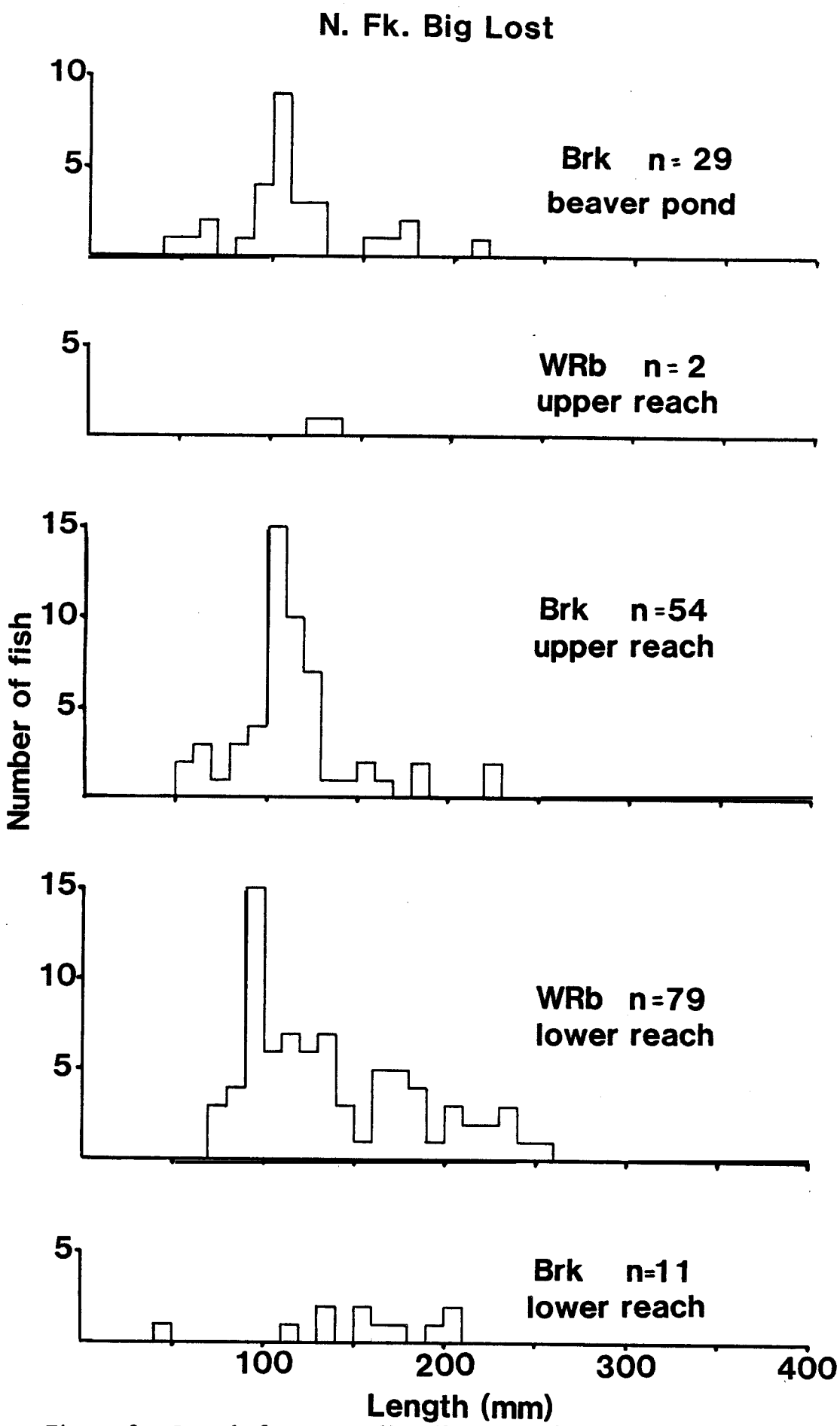

Figure 2. Length-frequency distributions of wild rainbow and brook trout captured in the North Fork Big Lost River.

North Fork Big Lost River - Summit Creek to Headwaters

Species composition changed from the lower North Fork to the upper North Fork, with brook trout becoming the predominant species. Mid-August estimates show a density of 26.6 wild trout/100 m^2 ($14.8 \leq D \leq 63.3$, 95% CI) for a 78 m long section near the mouth of Bear Creek. All but two of the wild trout were brook trout. Five brook trout fry were captured but not included in the estimate. One whitefish and four hatchery rainbow trout were also captured.

A beaver pond located on a spring seep adjacent to the Bear Creek reach was electrofished during the same August 15 to August 18 time period. All of the fish captured were brook trout, including four fry. The density estimate was 5.7 trout/100 m^2 ($2.8 \leq D \leq 18.9$, 95% CI) for the pond which had an area of 762 m^2. While the densities were lower than those in the stream channel, it is doubtful if any fish would exist there without the beaver pond.

We also electrofished a short section of stream in the headwaters. Despite habitat that appeared to be of good quality, only one wild rainbow was captured. The presence of a small waterfall, which limits upstream access to this reach, and possible harsh wintering conditions may be limiting fish populations there. We did note the presence of sculpins in this area.

Brook trout captured in the upper North Fork ranged from 45 mm to 225 mm total length with no apparent size difference between the stream channel and the beaver pond (Figure 2). All of the wild rainbow captured were less than 176 mm in length.

Lower East Fork

Population estimates were conducted on two sections of the lower East Fork using the mark-recapture method. Section 1, located between the mouth of Wildhorse Creek and the Whitworth ranch, was electrofished on July 31 and August 7. Section 2 is located immediately downstream from Fox Creek and was electrofished on July 11 and July 18. Both sections have good habitat, with an assortment of large pools, riffles, and pocket water.

Both sections contained similar densities of wild trout (Table 1), but Section 2 had higher densities of larger fish. Brook trout were nearly absent from Section 1 but made up over 36Z of the wild trout in Section 2. Hatchery rainbows were present in both sections. In both sections, whitefish were more numerous than trout.

Brook trout sampled from Sections 1 and 2 ranged in length from 40 mm to 285 mm (Figure 3). Wild rainbow trout lengths ranged from 40 mm to 495 mm. Twenty-four percent of the wild rainbows in Section 2 were longer than 250 mm, compared with only 6Z in Section 1. Whitefish lengths sampled from both sections ranged from 220 mm to 455 mm.

Table 1. Fish densities in sample sections of the upper Big Lost drainage, summer, 1986.

Location	Surface Area (ha)	Date	Wild Trout Densities Fish/100m²		Species Composition		No of Fry Captured	Whitefish Density	Hatchery Rainbow Density	Comments
			All Fish	Fish ≥ 150	All Fish	Fish ≥ 150 mm				
North Fork immediately downstream from USFS boundary	1.08	7/30-8/6	3.0	1.2	89% Rb 11% Brk	80% Rb 20% Brk	1 Brk	3.0	3.4	Habitat in good condition - stem
North Fork #1 Section downstream from Bear Creek	0.04	8/15	26.6	3.1	4% Rb 96% Brk	100%	6 Brk	<0.1	1.0	Habitat fair-good, some grazing damage
North Fork Beaver pond near Bear Creek	0.08	8/18-8/25	5.7	1.0	100% Brk	100%	4 Brk	0	0	Pond located on spring - habitat
East Fork #1 Downstream from Whitworth Ranch	1.71	7/31-8/7	1.7	0.3	99% Rb 1% Brk	99% Rb 1% Brk	4 Rb 1 Brk	4.8	<0.1	Good habitat - Fish up to 450
East Fork #2 Fox Creek downstream	1.37	7/11-7/18	1.5	0.9	63% Rb 37% Brk	53% Rb 47% Brk	2 Brk	5.3	0.5	Good habitat - Fish up to 500
Upper East Fork #1	0.02	10/3	6.8	4.7	64% Rb 36% Brk	78% Rb 22% Brk	0	0	0.8	Upstream from Burma Road Bridge north of structures - grazing damage

Table 1. Continued.

Location	Surface Area (ha)	Date	Wild Trout Densities Fish/100m²		Species Composition		No of Fry Captured	Whitefish Density	Hatchery Rainbow Density	Comments
			All Fish	Fish > 150 mm	All Fish	Fish > 150 mm				
Upper East Fork #2	0.03	10/3	8.2	6.2	67% Rb 33% Brk	76% Rb 24% Brk	3 Rb	0	11.6	Adjacent to Section 1 - Log structure present
Upper East Fork #3	0.01	9/26	55.3	44.0	34% Rb 66% Brk	31% Rb 69% Brk	1 Rb 5 Brk	0	0	Excellent meadow stream habitat, good pool-riffle ratio, undercut bank
Upper East Fork #4	0.01	9/26	52.7	40.7	39% Rb 61% Brk	40% Rb 60% Brk	7 Rb 6 Brk	0	0	Adjacent to Section 3
West Fork #1 Area near bridge	1.74	6/26-7/3	0.6	0.4	14% Rb 86% Brk	13% Rb 87% Brk	0	8.5	0.5	Fast water, few pools, limited bank cover
West Fork #2 Upstream from cow camp	1.52	7/10-7/17	3.2	1.8	12% Rb 88% Brk	12% Rb 88% Brk	0	2.3	0.4	Excellent habitat, good pool-riffle ratio, good banks, good riparian zone. Brk to 450 mm, Rb to 390 mm
Twin Bridges Crk #1 immediately down from culvert	0.03	5/8	3.0	0.5	70% Rb 30% Brk	50% Rb 50% Brk	2 Rb	<0.1	0	Habitat severely overgrazed
Twin Bridge Crk #2	0.03	5/8	4.8	1.6	94% Rb 6% Brk	100% Rb	7 Rb	0	0	Habitat severely overgrazed, mature rainbow present

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Table 1. Continued.

Location	Surface Area (ha)	Date	Wild Trout Densities Fish/100m²		Species Composition		No of Fry Captured	Whitefish Density	Hatchery Rainbow Density	Comments
			All Fish	Fish > 150 mm	All Fish	Fish > 150 mm				
Summit Crk #1	0.14	8/19-8/25	24.3	6.0	4% Rb 96% Brk	16% Rb 84% Brk	16 Brk	<0.1	0	Habitat good to excellent, log structures present
Summit Crk #2	0.12	8/19-8/25	13.8	3.2	100% Brk	100% Brk	1 Brk	0	0	Similar to Section 1 w/o logs
Summit Crk #3	0.07	8/15	55.3	5.8	100% Brk	100% Brk	28 Brk	0		Good riffle-pool structure
Summit Crk #4	0.03	8/18-8/25	15.2	7.8	100% Brk	100% Brk	3 Brk	0	0	Beaver ponds - "bonus habitat" old ponds
Wild Horse Crk #2	0.03	9/19	5.8	0.6	6% Rb 94% Brk	50% Rb 50% Brk	0	0	0.3	Steep gradients, pools and
Wild Horse Crk #3	0.15	9/19	2.5	0.5	100% Brk	100% Brk	4 Brk	0	0.1	Low gradient, pools and riffles - good habitat
Fox Creek #2	0.02	5/8	4.0	1.1	100% Rb	100% Rb	6 Rb	0	0	Small stream, good habitat, upstream from diversion
Starhope Crk #1	0.03	9/24	2.0	1.7	100% Brk	100% Brk	0	0	8.6	Main stem beaver pond
Starhope Crk #2	0.07	9/24	0.5	0.4	100% Brk	100% Brk	0	0	7.3	Habitat good to excellent

Table 1. Continued.

Location	Surface Area (ha)	Date	Wild Trout Densities Fish/100m²		Species Composition		No of Fry Captured	Whitefish Density	Hatchery Rainbow Density	Comments
			All Fish	Fish > 150 mm	All Fish	Fish > 150 mm				
Starhope Creek #3	0.05	9/24	1.6	1.0	100% Brk	100% Brk	0	0	0	Habitat fair - could use boulder or log structures
Muldoon Canyon Creek #1	0.08	9/25	2.7	0.4	19% Rb 81% Brk	50% Rb 50% Brk	29 Brk	0	1.7	Habitat Fair
Muldoon Canyon Creek #2	0.11	9/25	3.7	0.9	100% Brk	100% Brk	44 Brk	0	0.9	Habitat good to excellent
Muldoon Canyon Creek 43	0.06	9/25-10/2	20.9	8.1	100% Brk	100% Brk	39 Brk	0	0	Beaver pond on spring seep, "bonus" habitat
Muldoon Canyon Creek #4	0.08	9/24	8.3	2.0	100% Brk	100% Brk	5 Brk	0	0.6	Habitat fair - limited cover
Lake Creek #1	0.02	9/25	23.6	20;9	8% Rb 91% Brk 1%Ct	10% Rb 87% Brk ,3%Ct	0	0	17.7	Excellent pool habitat
Lake Creek #2	0.02	9/25	6.0	3.4	100% Brk	100% Brk	0	0	2.2	Riffles, undercuts
Lake Creek #3	0.06	9/25	8.4	4.3	2% Rb 98% Brk	4% Rb 96% Brk	0	0 0	0.3	Riffles, undercuts

Table 1. Continued.

Location	Surface Area (ha)	Date	Wild Trout Densities Fish/100m²		Species Composition		No of Fry Captured	Whitefish Density	Hatchery Rainbow Density	Comments
			All Fish	Fish > 150 mm	All Fish	Fish > 150 mm				
Lake Creek Beaver Ponds	0.05	9/25-10/2	5.1	4.5	100% Brk	100% Brk	1 Brk	0	0	"Bonus habitat"
Cabin Creek #1	0.06	10/2-10/7	96.2	23.0	51% Rb 49% Brk	53% Rb 47% Brk	67 Rb	0	0	Excellent spring creek habitat
Corral Creek 11	0.02	10/2-10/7	17.8	14.4	27% Rb 73% Brk	16% Rb 84% Brk	2 Rb	0	0	Habitat good - brushy, springs

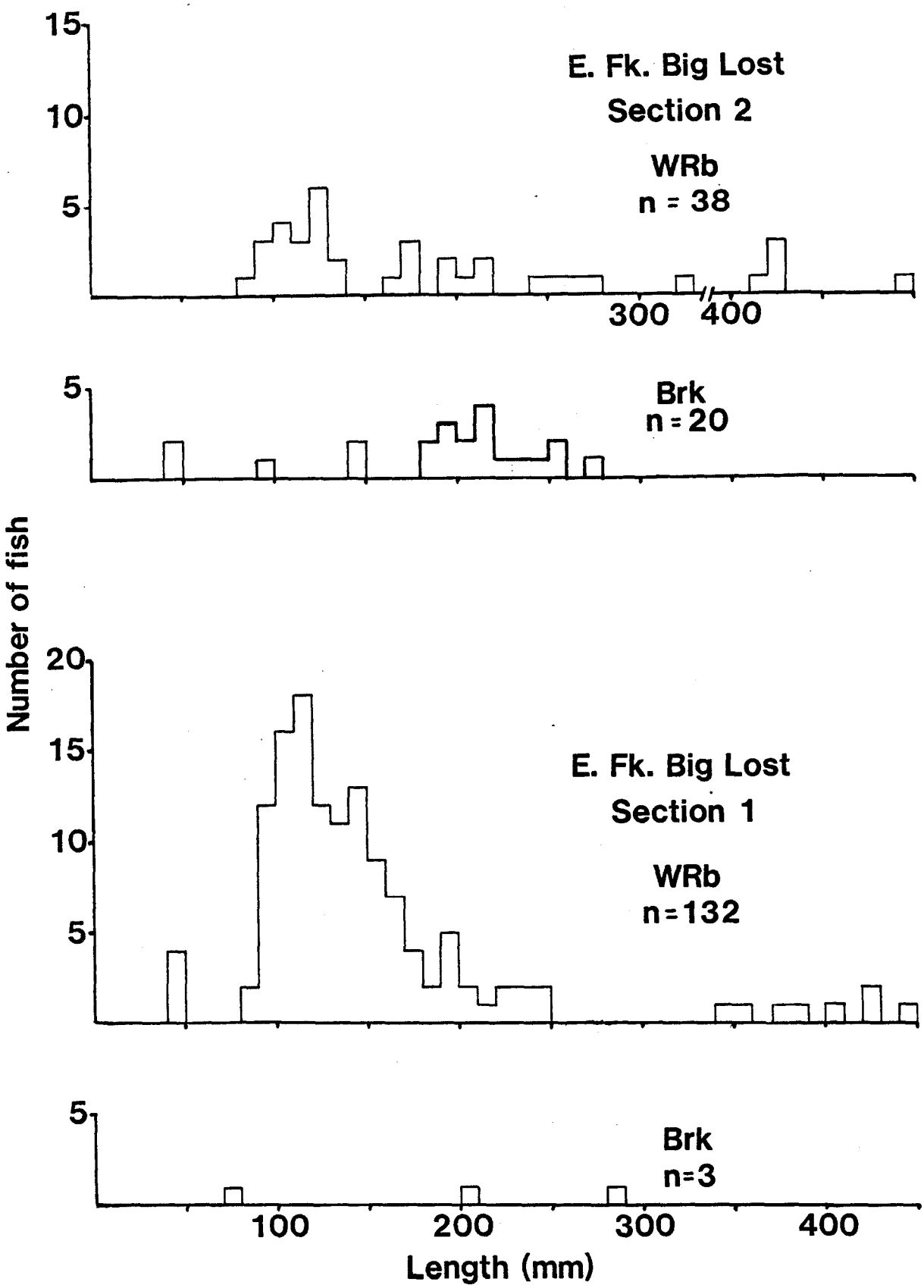

Figure 3. Length-frequency distributions of wild rainbow and brook trout captured in Sections 1 and 2 of the lower East Fork Big Lost River.

West Fork

Two distinct habitat reaches are found in the West Fork. The lower reach, from the mouth to Starhope Point, is characterized by long, shallow riffles, few pools, and limited riparian habitat. The upper reach meanders through a dense riparian zone. Pools and side channels are common, and overall habitat is excellent. We electrofished one section in each reach.

Section 1 (lower reach) was sampled'on June 26 and July 3. Whitefish densities were higher in Section 1 than in any other area sampled, but trout densities were low (Table 1). In Section 2, sampled on July 10 and July 17, whitefish were outnumbered by trout. Trout densities were also higher than in any other main stem reach (Table 1). In both sections, brook trout were more numerous than rainbow trout.

The largest brook trout captured in the upper Big Lost River study was a 455-mm female from Section 2. Overall, brook trout in the West Fork ranged from 90 mm to 455 mm (Figure 4). Rainbows ranged from 85 mm to 390 mm.

Twin Bridges Creek

Two population estimates were conducted on Twin Bridges Creek on May 8. Section 1 was located immediately downstream from the road culvert and was 81 m long. We estimated the population size in Section 1 at ten trout, with 701 being rainbows and 30Z brook trout. Total density was three trout/100 m^2 ($2.1 \leq D \leq 3.8$, 95% CI). Section 2, located approximately 4.5 km upstream and measuring 114 m, had slightly higher densities of trout. The estimated number of trout in Section 2 was 18, with a density of 4.8/100 m^2 ($4.2 \leq D \leq 5.3$, 95% CI). Except for one brook trout, all of the fish captured were rainbows.

Total length of rainbow trout ranged from 51 mm to 292 mm (Figure 5). Four ripe, mature male rainbows were observed, ranging from 185 mm to 292 mm. Brook trout were primarily small fish measuring from 97 mm to 162 mm. All of the fish larger than 100 mm long were associated with pools or overhanging cover, habitat which is in limited supply due to the severe grazing problem.

The road culvert on Twin Bridges Creek does not appear to be a block to migrating rainbow trout. Several large fish were observed upstream of the culvert during June, indicating fish were able to negotiate it.

Summit Creek

We used the mark-recapture method to estimate the numbers of fish in four sections of Summit Creek during August. Section 1, the lower-most site, consists of pools, riffles, and runs augmented by log structures and flows primarily through a sparsely-wooded area. Section

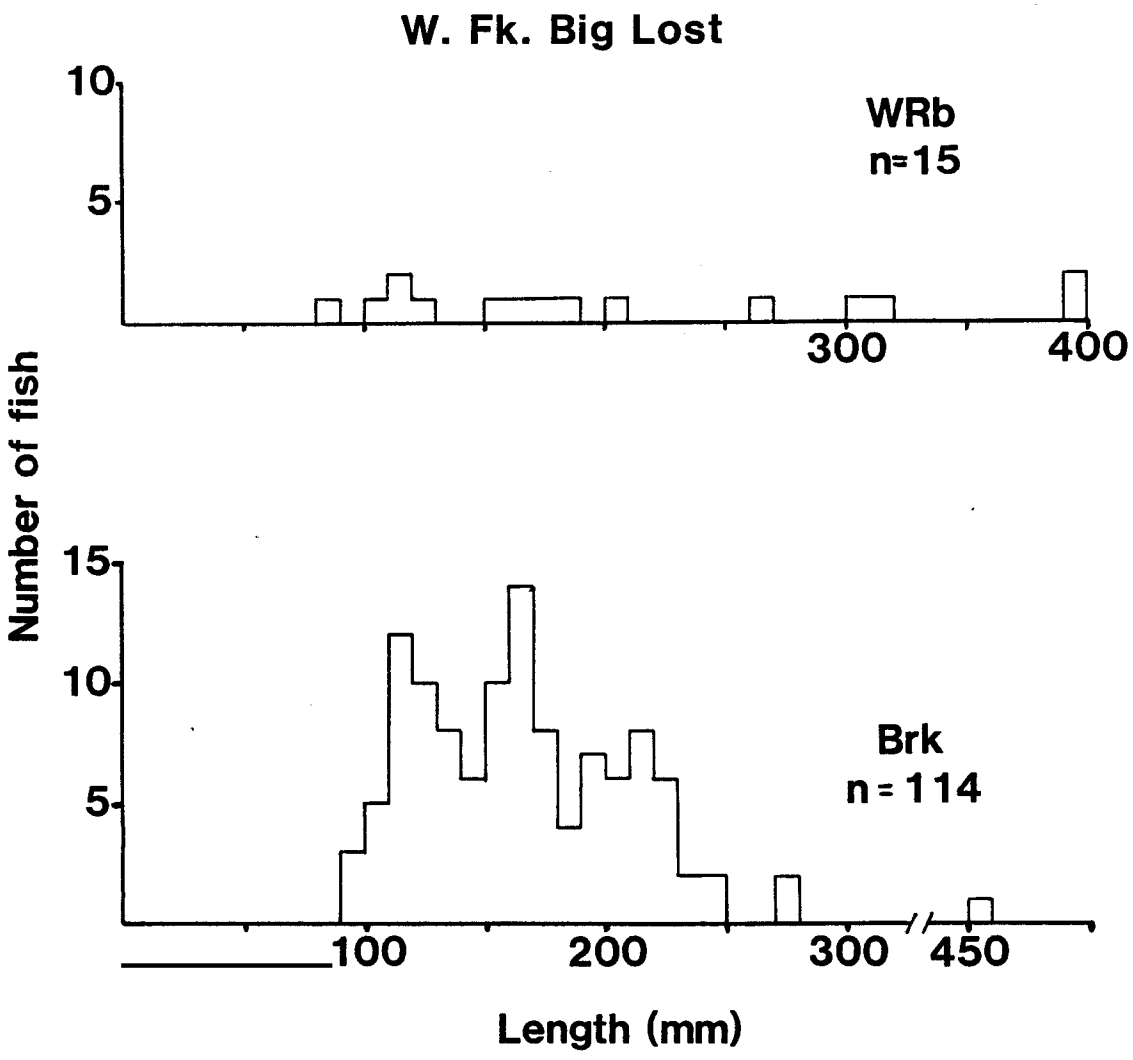

Figure 4. Length-frequency distributions for wild rainbow and brook trout captured in the West Fork Big Lost River.

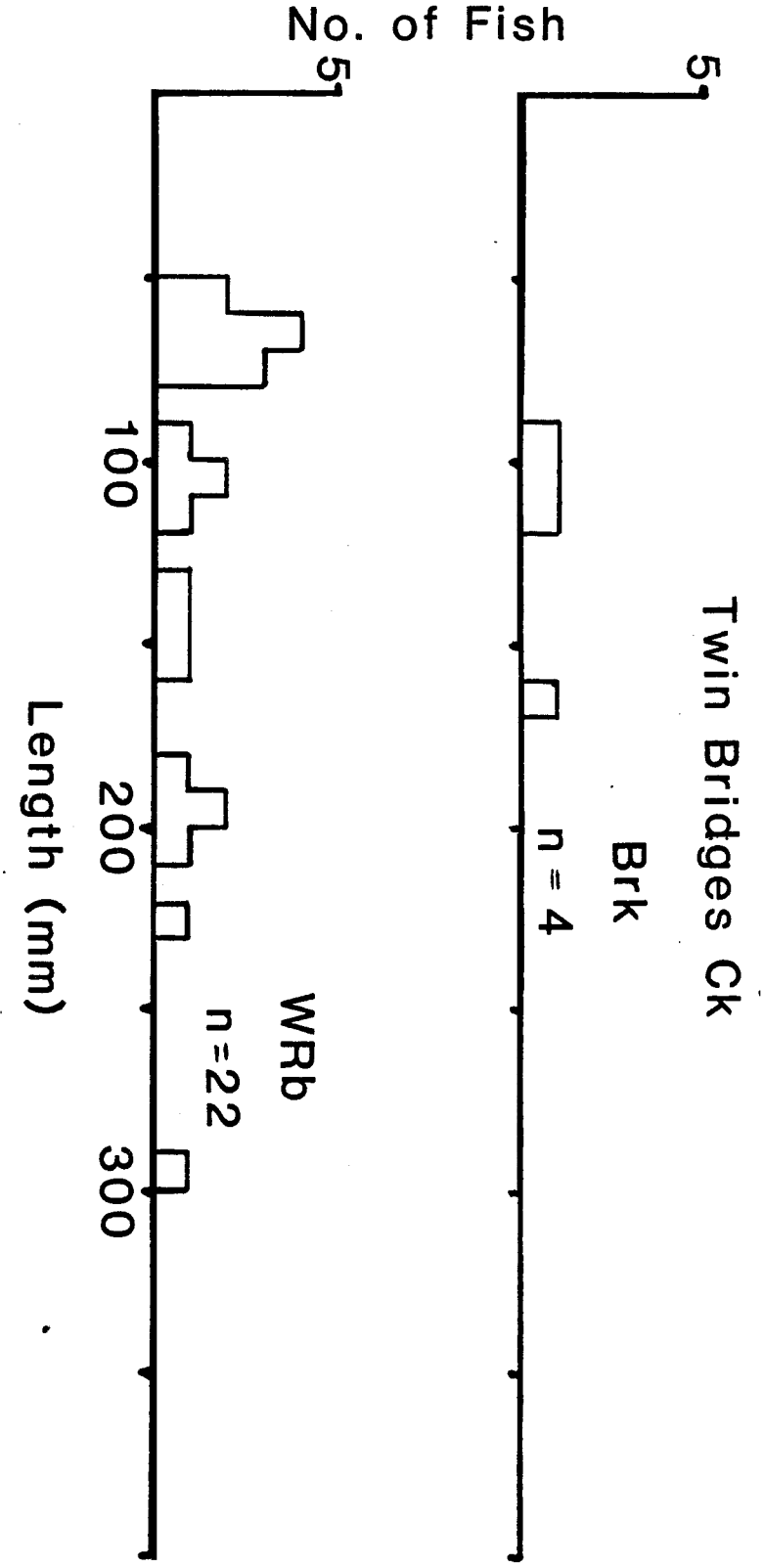

Figure 5. Length-frequency distribution of fish captured from Twin Bridges Creek, 1986.

2 is located immediately upstream and consisted of mostly similar habitat to that in Section 1 without the presence of log structures. Habitat in Section 3, located upstream from the Phi Kappa Campground, consisted of riffles and pools with overhanging willows. Section 4 consisted of two adjacent beaver ponds located on a spring which flows into Summit Creek in the upper meadows area. The beaver ponds provide habitat that would otherwise not exist.

With the exception of a few wild rainbow trout and whitefish in Section 1, all of the salmonids captured were brook trout (Table 1). Brook trout densities were highest in Section 3 and lowest in Section 2. Comparison of densities in Sections 1 and 2 indicate that log structures benefit the fishery in the lower reach, particularly for larger, catchable-sized fish. Densities in the beaver ponds were comparable to those in the habitat improvement area further downstream, but the ponds had the highest density of catchable-size fish.

Brook trout captured in Summit Creek ranged in length from 36 mm to 240 mm, with several distinct size groups evident (Figures 6a and 6b). All of the brook trout larger than 150 mm were mature fish. Rainbows measured from 90 mm to 235 mm in length.

Kane Creek, a tributary to Summit Creek with similar habitat, also supports brook trout. No estimates of brook trout densities in Kane Creek were made, however.

Wildhorse Creek

Four sections of Wildhorse Creek were electrofished in September 1986. No fish were captured in either Section 1 or Section 4; thus, no estimates were made. In Sections 2 and 3, enough fish were present to use the two-pass method, but densities were low (Table 1). One wild rainbow trout was observed, but the remainder of the wild fish were brook trout ranging from 50 mm to 225 mm (Figure 7). A mature male brook trout measured 142 mm and a mature female measured 162 mm. Hatchery rainbow were also captured, but their low number indicated a high utilization by anglers.

Section 2, which had the highest densities of fish, was a steep gradient section with small pools, large boulders, and several small cascades. Section 3 is a flat gradient area with large pools and riffles and undercut banks. Habitat in Section 4 was similar to that in Section 2, but there was less tree cover. Section 1 had very little habitat and appeared to have been altered by the 1984 flood.

Fox Creek

Fox Creek, a small tributary to the East Fork, has a small diversion on it approximately 1 km upstream from its mouth. We electrofished two short sections of Fox Creek, one on each side of the diversion on May 9. In the lower section, no estimate was conducted, but we captured four wild rainbow and one whitefish. The largest fish

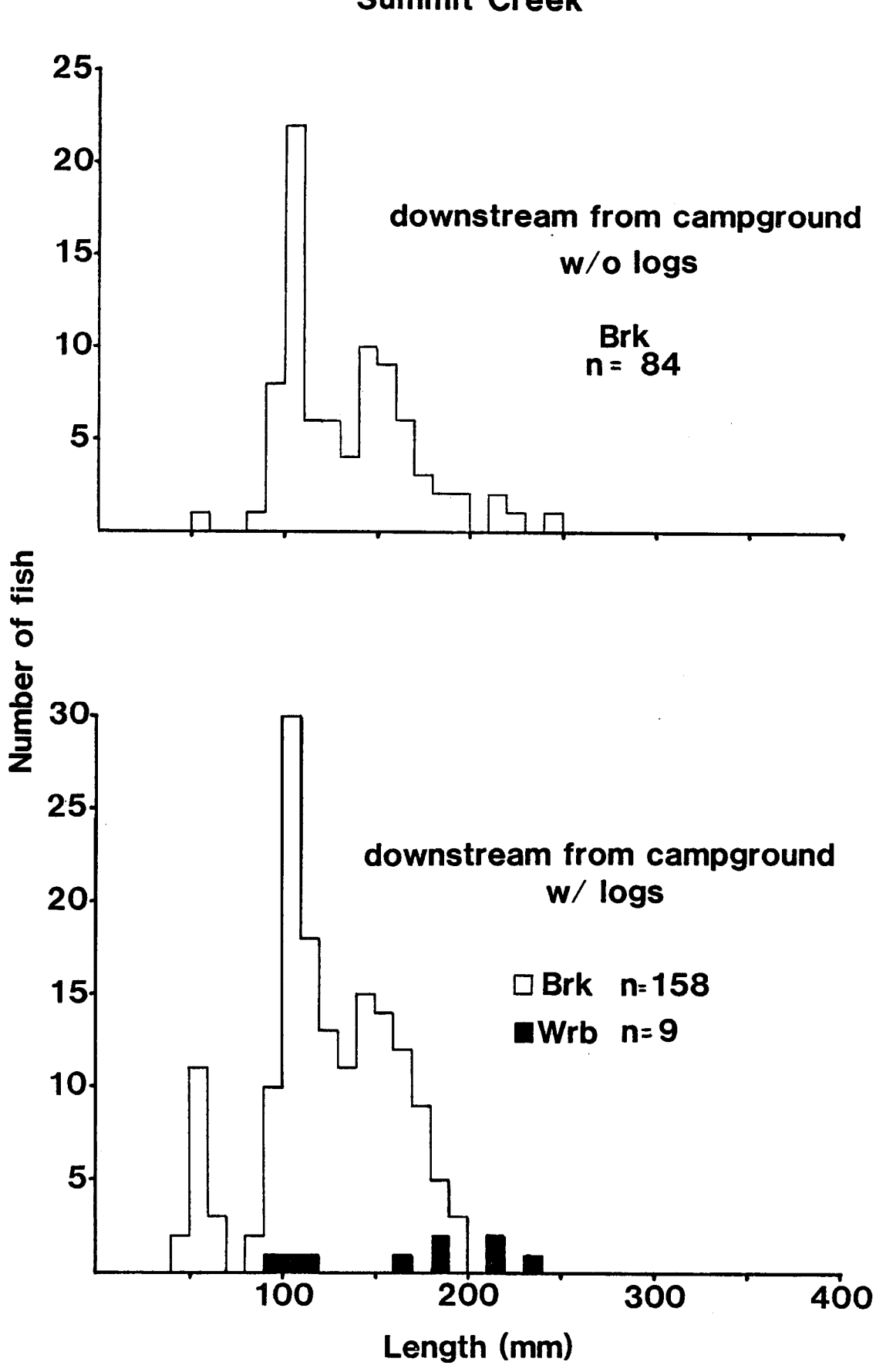

Figure 6a. Length-frequency distributions of wild rainbow and brook trout captured in Sections 1 and 2 of Summit Creek.

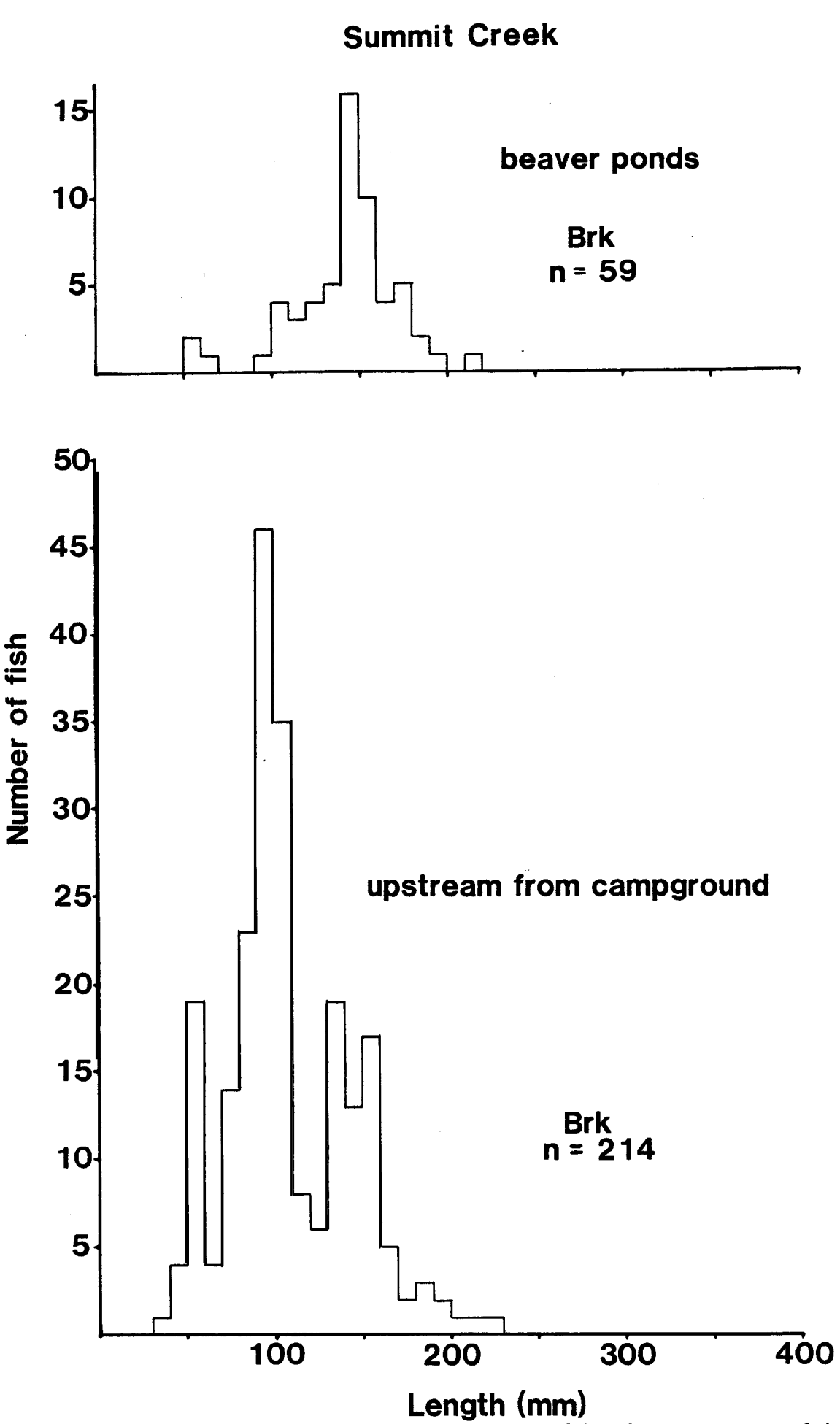

Figure 6b. Length-frequency distributions of brook trout captured in Sections 3 and 4 of Summit Creek.

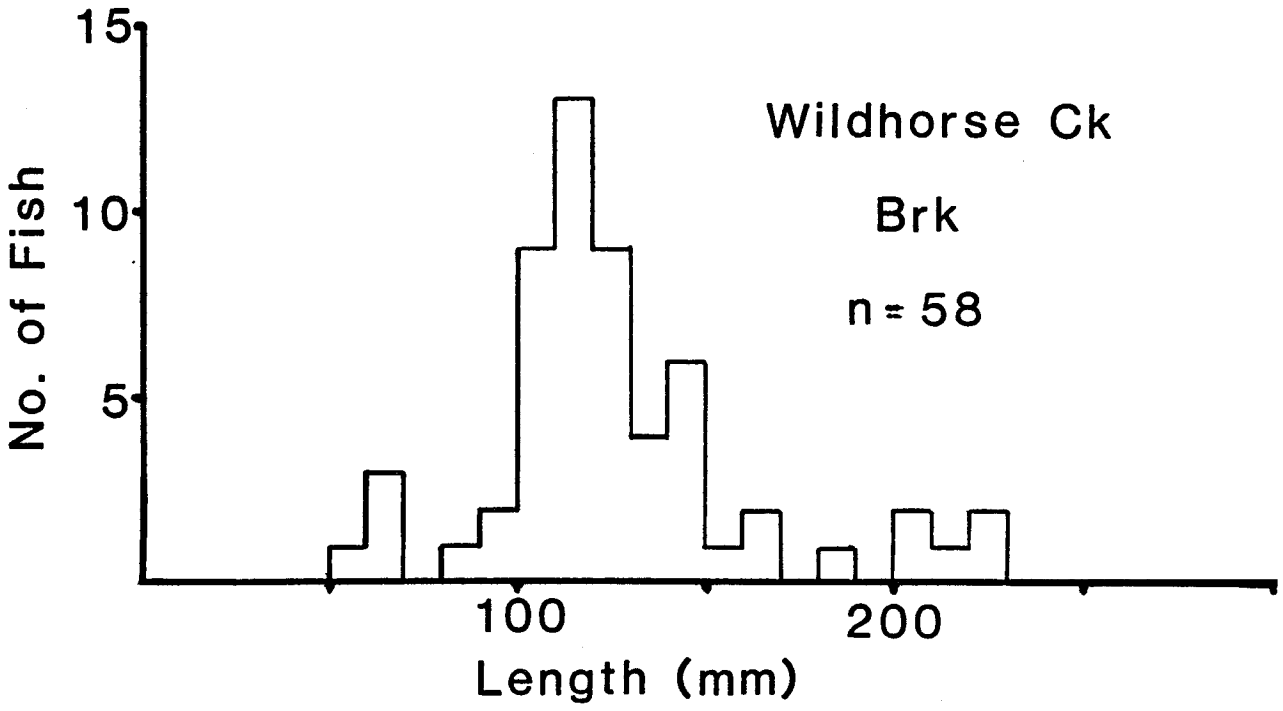

Figure 7. Length-frequency distribution of brook trout captured from Wildhorse Creek, 1986.

measured 259 mm and showed evidence of hybridization with cutthroat. In the upper section, we captured 13 wild rainbow ranging from 55 mm to 289 mm. A ripe, mature male (209 mm) and a ripe, mature female (289 mm) rainbow trout were present in this section. Density of fish larger than 70 mm was 4 fish/100 m^2. The number of small fish (50 mm to 70 mm) would indicate that first-year growth is slow in Fox Creek.

Starhope Creek

Starhope Creek is the headwater tributary to the West Fork. We conducted population estimates on three sections, two downstream from the loop road and one upstream from the loop road, during September. Section 1, a new beaver pond constructed last fall on the main channel, had slightly higher densities of brook trout than the other two sections (Table 1). Section 2 is good habitat but had moderate densities of hatchery rainbow trout, indicating that hatchery rainbow are not being heavily utilized in Starhope Creek. Section 3, located upstream from the loop road, had poorer quality habitat than the lower sections but similar brook trout densities. No wild rainbow trout were observed in any of the sections.

Brook trout ranged in length from 110 mm to 215 mm (Figure 8). The lack of fry in the sample may indicate that Starhope Creek is recruitment-limited.

Muldoon Canyon Creek

Muldoon Canyon Creek, a tributary to the West Fork, flows through an open canyon for much of its course. We chose three on-channel sections and one off-channel beaver pond to conduct population estimates on. Electrofishing was conducted in late September, and we used the mark-recapture method.

Section 1, located immediately downstream from the loop road, had good habitat but the lowest densities of wild trout of the four sections (Table 1). Brook trout made up 81% and rainbows 19% of the wild fish present. Hatchery rainbows were also present.

Section 2 is located a short distance upstream from the loop road and consists of good habitat with undercut banks and deep pools. Densities in Section 2 were only slightly higher than in Section 1, and no wild rainbow trout were present.

Section 3 is an off-channel, active beaver pond adjacent to Section 2. Weed growth provides excellent cover, and the pond is approximately 1.5 m deep at the deepest point. Because the pond is on a small spring, it provides habitat that would otherwise not be present. Densities of brook trout (the only game species present) were considerably higher than those in other portions of the stream (Table 1), and larger fish were also present (Figure 9). The 356 mm long male brook trout taken from this pond was the second largest brook trout we observed in the drainage.

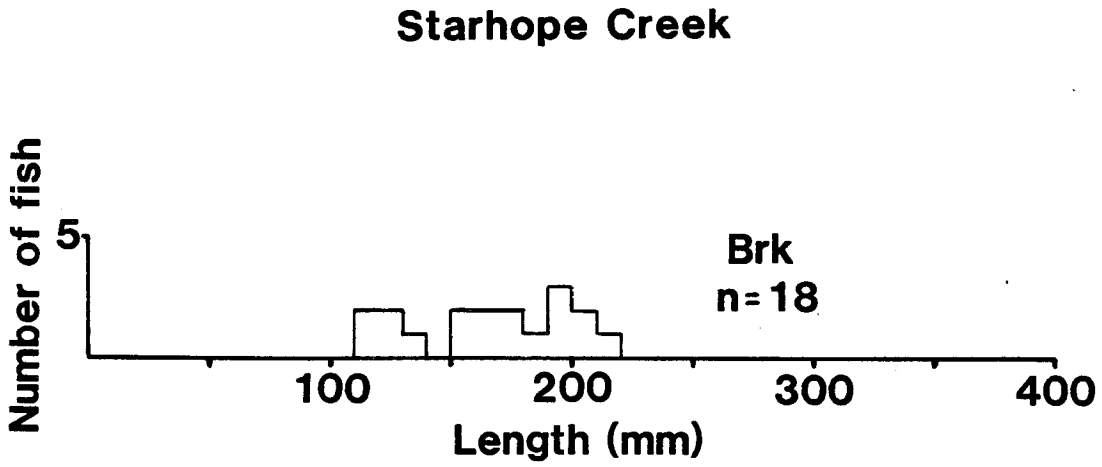

Figure 8. Length-frequency distribution of brook trout captured in Starhope Creek.

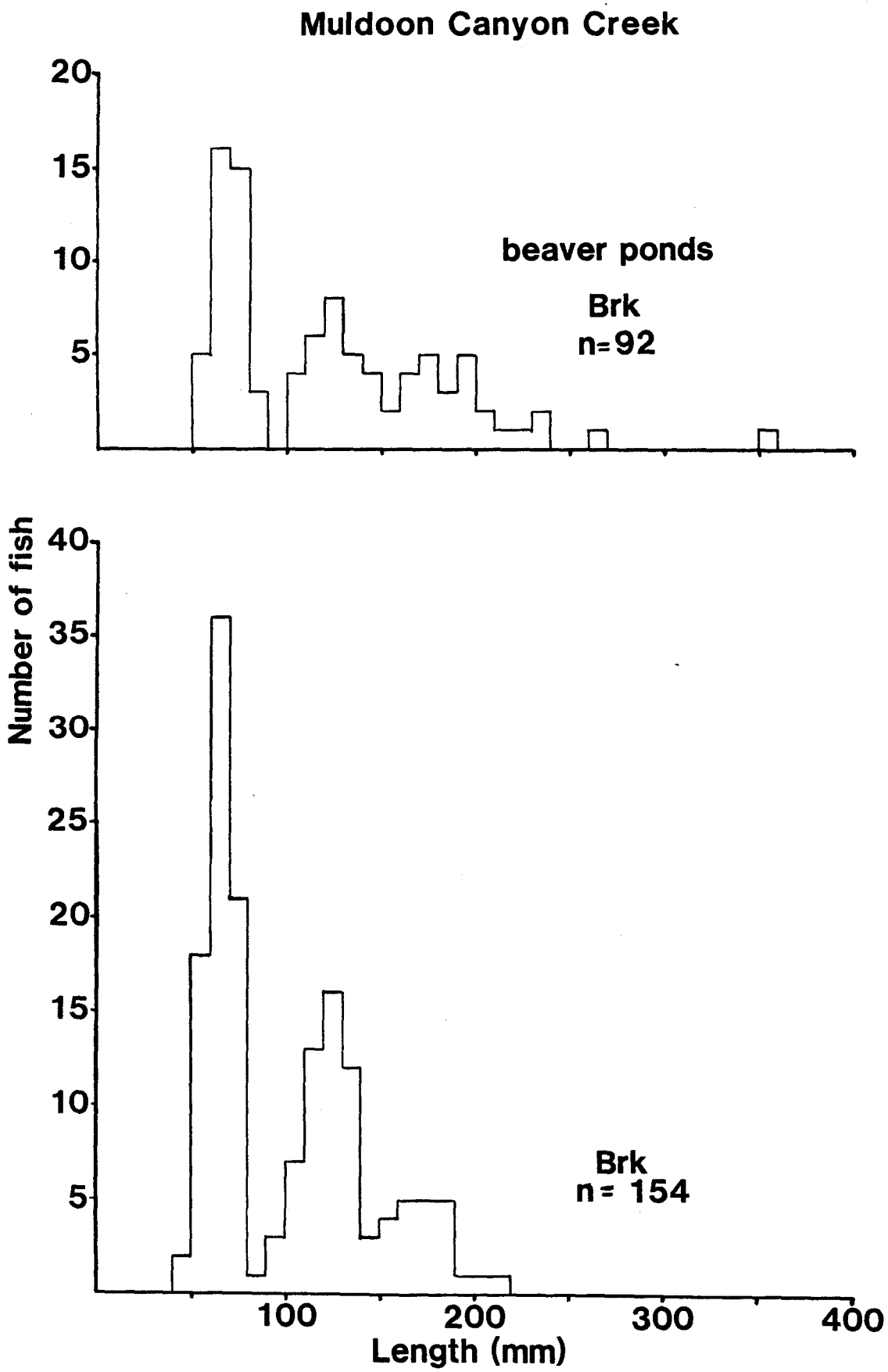

Figure 9. Length-frequency distributions of brook trout captured in Muldoon Canyon Creek.

Section 4 had moderate brook trout densities despite limited habitat. Some hatchery rainbow were also present. Grazing damage and apparent flood damage have resulted in this section having only limited pool area.

In main channel areas of Muldoon Canyon Creek, brook trout ranged from 40 mm to 220 mm total length (Figure 9). Brook trout in the beaver pond ranged from 50 mm to 356 mm. Both areas show distinct size groups.

Lake Creek

We electrofished three mainstem sections and one beaver pond section on Lake Creek during September 1986. Sections 1 and 2 are adjacent to each other and located approximately 0.5 km downstream from the loop road. Section 3 is located approximately 0.5 km upstream from the Lake Creek trail head. The beaver pond is situated on a small seep in the vicinity of the two lower sections.

We observed the highest densities of fish in Section 1 (Table 1), which consisted primarily of a deep pool with overhanging cover. Brook trout comprised over 90Z of the wild fish, followed by rainbows and a cutthroat trout. The cutthroat trout was the only one observed during the study and probably had drifted down from one of the mountain lakes. Hatchery rainbow were also abundant in Section 1.

Section 2 consisted of riffles and pocket water. Densities of both wild and hatchery fish were considerably lower in Section 2 than in Section 1, with brook trout being the only wild species present (Table 1).

Section 3 consists mainly of small pools in a steep gradient reach. Brook trout were the predominant species, with both hatchery and wild rainbow trout also present. Densities were similar to those in Section 2 (Table 1).

The beaver pond had a maximum depth of about 1.5 m. Food caches, two lodges, and overhanging vegetation provide good cover for fish. All of the fish captured were brook trout. Although densities were similar to those in Sections 2 and 3 (Table 1), the size structure was considerably different (Figure 10). Larger fish make up the bulk of the population in the beaver pond.

Brook trout captured from Lake Creek ranged in size from 90 mm to 245 mm. All of the brook trout longer than 140 mm were mature, and one mature female measured 122 mm. Evidently, some factor is limiting fry recruitment in Lake Creek, or fry are isolated from other segments of the populations as we did not sample any.

Corral Creek

We completed one population estimate on Corral Creek immediately downstream from the Burma Road in early October. Springs temper the water and grazing damage is evident in this section. Densities of fish

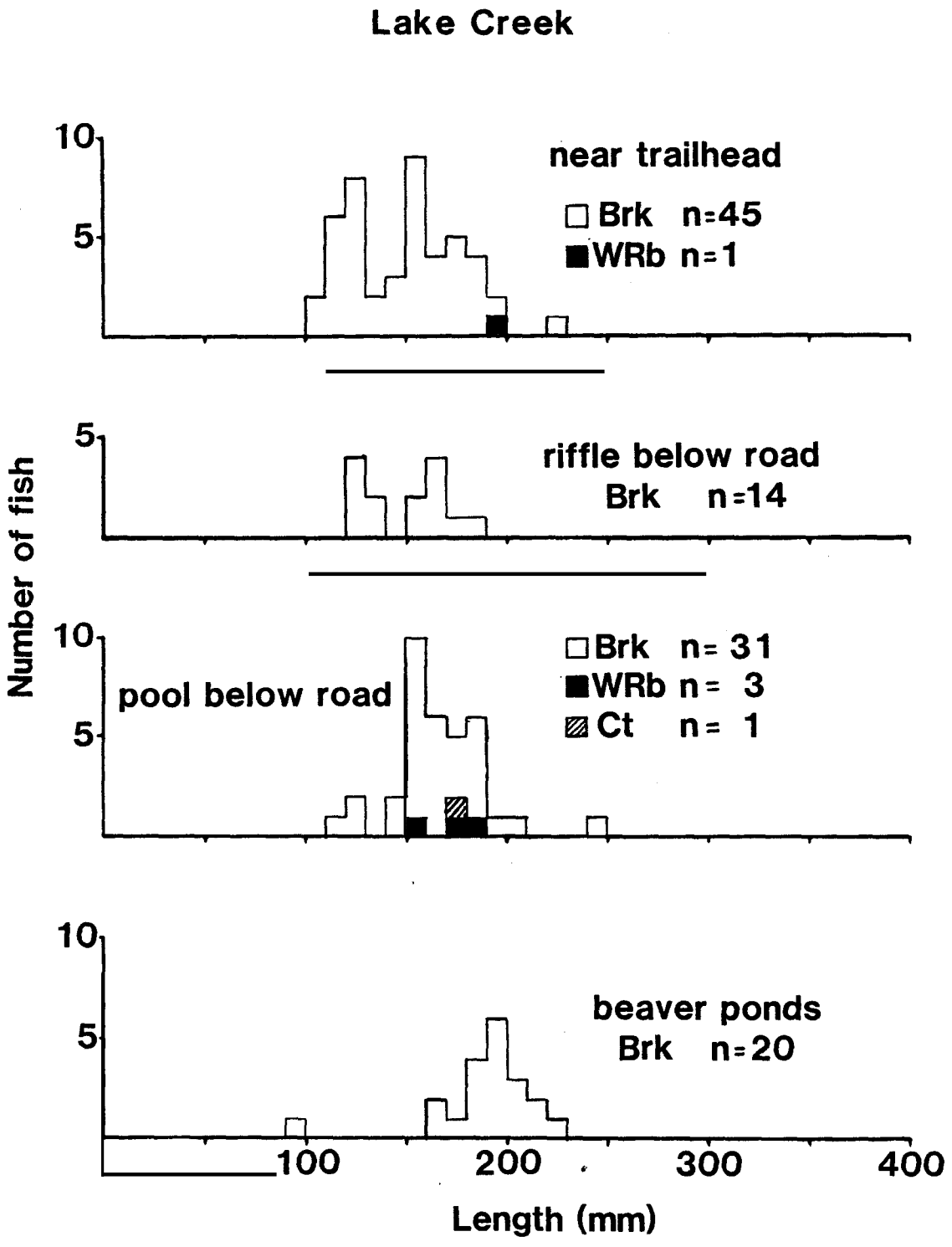

Figure 10. Length-frequency distributions of brook, wild rainbow and cutthroat trout captured in Lake Creek.

were relatively high (Table 1), with brook trout comprising nearly three-fourths of the fish sampled. Wild rainbow trout were also present.

Brook trout ranged in length from 105 mm to 205 mm, with 84% of the fish larger than 160 mm (Figure 11). All of the larger brook trout were mature fish. Wild rainbow trout ranged from 50 mm to 200 mm.

We attempted to sample a large beaver pond on Corral Creek with a trap net but were unsuccessful. Anglers reported catching brook trout longer than 250 mm from the Corral Creek beaver ponds.

Cabin Creek

One population estimate was completed on Cabin Creek just upstream from the Burma Road Bridge. The channel in this section is weedy with a gravel substrate and is spring-fed. Sampling was done during the first week of October. We estimated a population density of 96.2 trout/100 m^2, the highest recorded anywhere in the drainage (Table 1). Brook trout and wild rainbow trout were present in approximately equal numbers.

An estimated 24% of the fish were larger than 150 mm, with brook trout ranging in length from 80 mm to 240 mm and rainbows from 55 mm to 240 mm. Distinct size groups were evident for both species (Figure 12). The smallest mature brook trout was a 122 mm male, and all of the brook trout 160 mm long were mature. Eight rainbow trout were sacrificed to assess gonad development. Of the eight, four were mature. Two of these were ripe and two had undeveloped testes, indicating that both spring and fall spawning rainbows are present in Cabin Creek.

Upper East Fork

We electrofished'four sections of the upper East Fork, two a short distance upstream from the Burma Road Bridge (Section 1 and 2), and two in the swamps (Sections 3 and 4). Sampling was done during late September and early October.

Section 1 and Section 2 are adjacent to each other, but Section 2 had drop-log structures, whereas Section 1 did not. Section 2 had slightly higher estimated densities of wild trout than Section 1 (Table 1). Rainbows made up approximately two-thirds of the wild fish present in both sections. Hatchery rainbows, which were nearly absent from Section 1, made up the largest portion of the fish sampled in Section 2. Evidently, hatchery fish are keying in on log structures and the associated pools as suitable habitat.

Combined densities of brook and rainbow trout in Section 3 and 4 were similar, with estimates of over 50/100 m^2 in both sections (Table 1). Only Cabin Creek had a higher estimated density, and the densities of fish over 150 mm long in the swamps exceed that in Cabin Creek. Brook trout made up 60% of the estimated trout in Section 3 and 66% in Section 4.

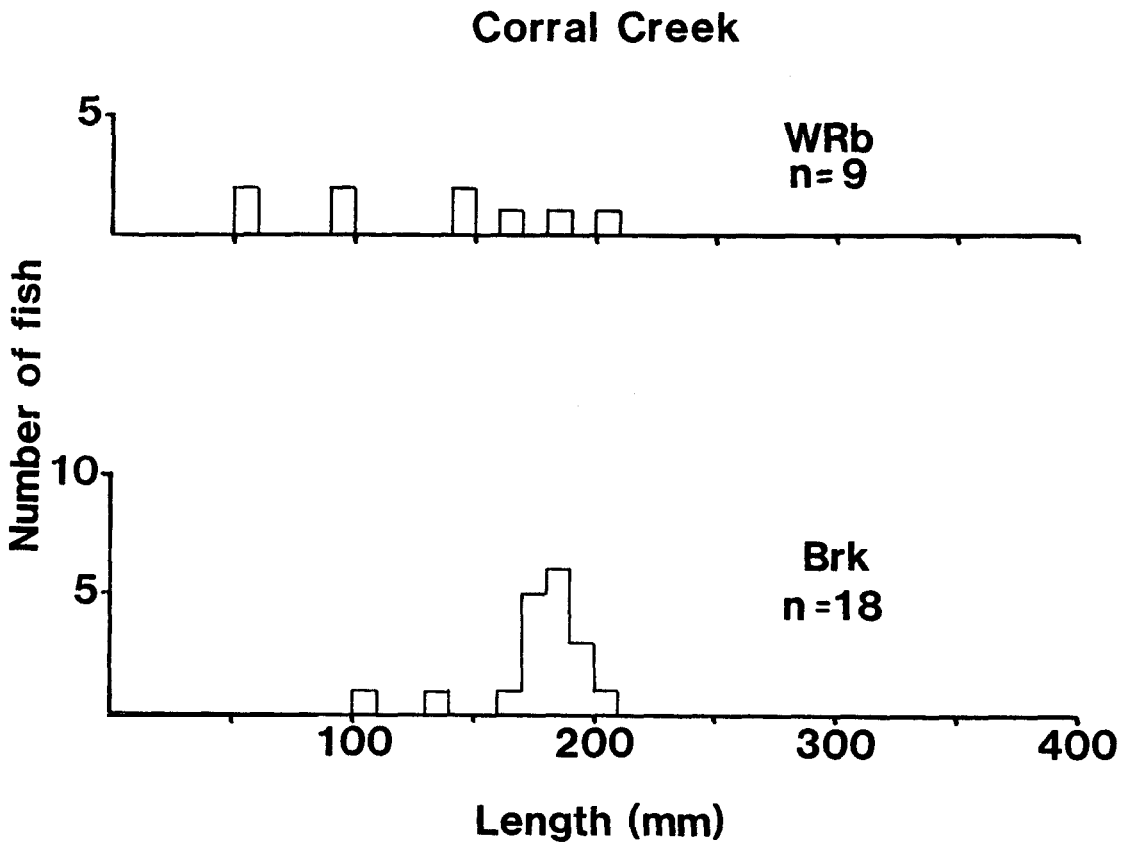

Figure 11. Length-frequenmcy distributions of wild rainbow and brook trout captured in Corral Creek.

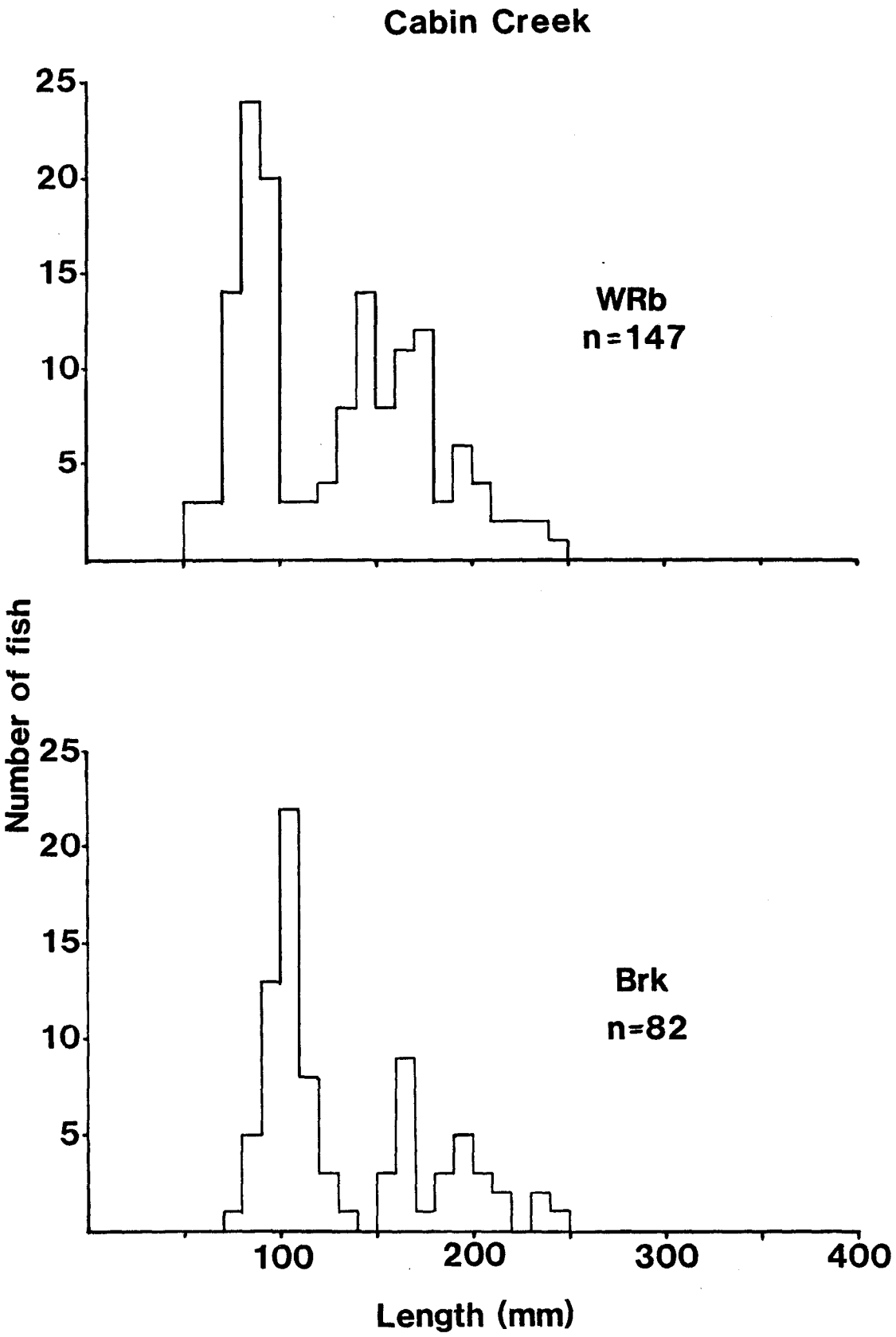

Figure 12. Length-frequency distribution of wild rainbow and brook trout captured in Cabin Creek.

Lengths of wild rainbows in Sections 1 and 2 were similar to those in Sections 3 and 4 (Figures 13 and 14). Brook trout also showed a similar length frequency distribution in all sections.

The difference in densities between the two lower sections (1 and 2) and the two upper sections (3 and 4) are probably related to both habitat and fishing pressure. Grazing damage in Sections 1 and 2 has resulted in some loss of undercut banks, while Sections 3 and 4 have excellent undercut bank cover. Also, because of their proximity to the Burma Road, Sections 1 and 2 receive much more fishing pressure than the Swamps area, which is somewhat isolated from road access.

Age and Growth

Scales were analyzed from 187 brook trout and 73 wild rainbow trout from around the drainage. Because body-scale relationships were statistically similar (analysis of covariance, $P<0.05$) from different populations of each species, data were pooled to develop a single body-scale equation for both brook trout and rainbow trout. Sizes at scale formation were determined from the literature for both species and included in the calculation of the body-scale equations.

Brook Trout

The body-scale relationship for brook trout was best described by the linear equation: length of fish = 15.95 + 5.67 (ASR)(r^2 = 0.74). Only two of the brook trout successfully aged were older than 3+. Both fish were taken from the West Fork. Other large brook trout were occasionally captured, but scale samples were not readable. Overall, growth rates were relatively consistent throughout the drainage (Table 2). Brook trout aged from the Lake Creek and Summit Creek beaver ponds appear to grow slightly faster than brook trout from nearby free-flowing reaches, but this was not verified statistically due to small sample sizes.

Growth of brook trout in the upper Big Lost River drainage is comparable to slow growing fish from Canada and probably typical of small streams (Scott and Crossman 1973). Evidently, the genetic potential exists for brook trout from the Upper Big Lost River to grow to large sizes, but some factor or factors is limiting the number of fish which grow to those sizes.

Rainbow Trout

The third degree polynomial equations, length of fish = 42.64 + 2.32 (ASR) + 0.01 $(ASR)^2$ - 0.0000875 $(ASR)^3$, best described the body-scale relationship for rainbow trout from the upper Big Lost River (r^2 = 0.83). Although small sample sizes precluded statistical analysis, it appears that the fastest growing fish are from the West Fork (Table 3). The largest rainbow trout captured during the study measured 495 mm and was taken from the lower East Fork. As with

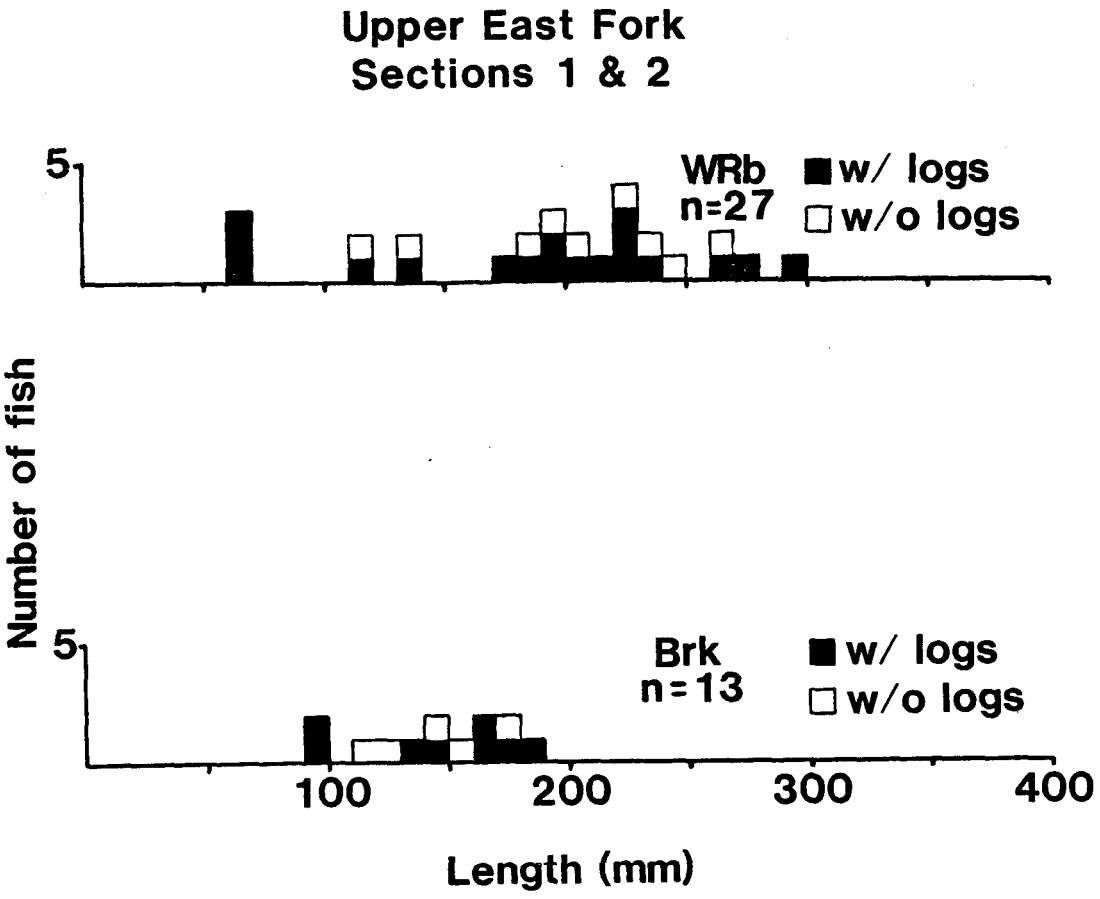

Figure 13. Length-frequency distribution of wild rainbow and brook trout captured in Sections 1 and 2 of the Upper East Fork Big Lost River.

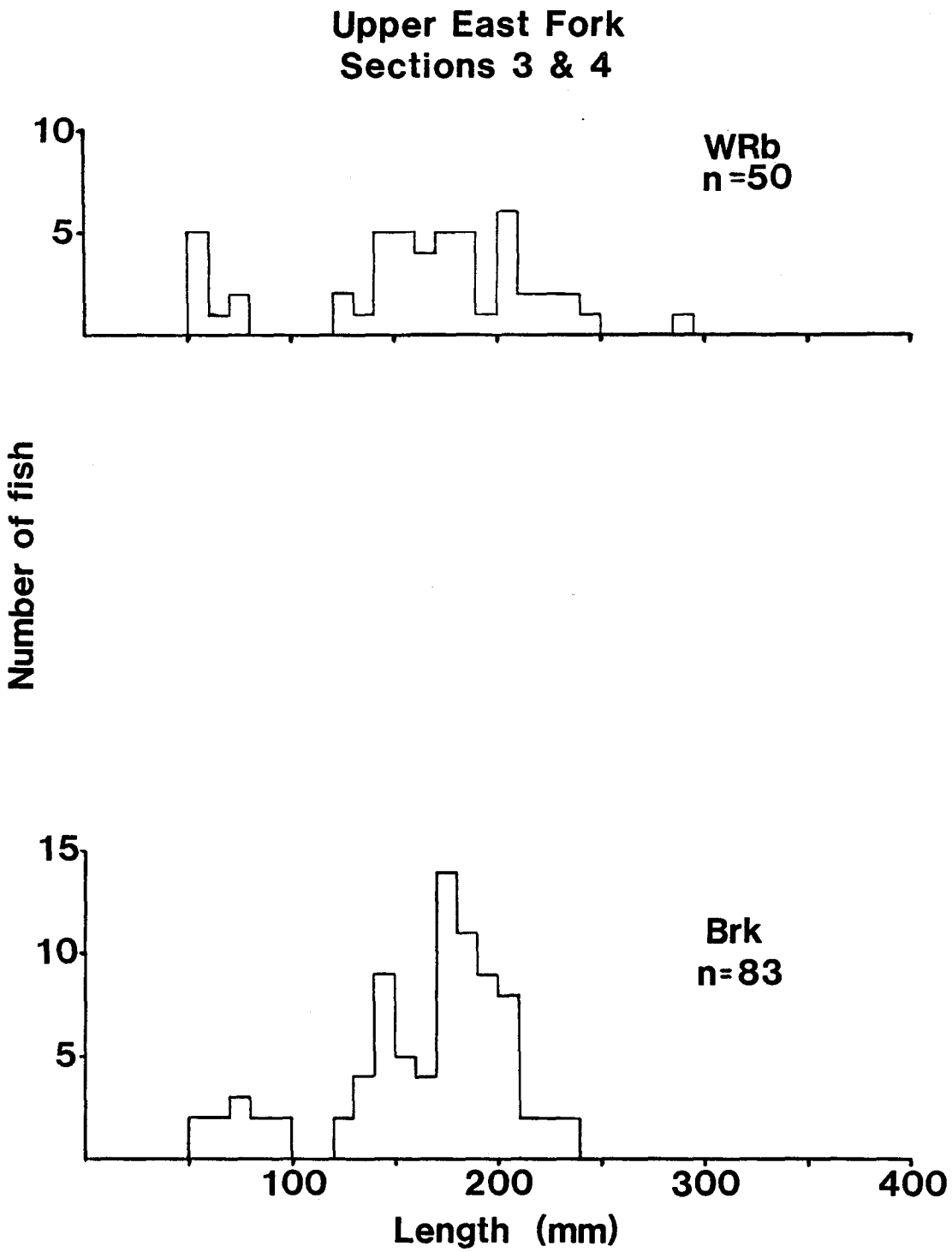

Figure 14. Length-frequency distributions of wild rainbow and brook trout captured in Sections 3 and 4 of the Upper East Fork Big Lost River.

Table 2. Comparison of brook trout size at annulus from streams in the upper Big Lost River drainage.

Stream	N	Size at annulus (mm) 1	2	3	4	5
Starhope Creek	16	90	141	186		
Muldoon Creek[a]	7	90	142	193		
Lake Creek (beaver ponds)	14	93	- 162	205		
West Fork	42	92	142	181	228	367
Summit Creek	36	99	149	186		
Summit Creek (beaver ponds)	13	10	162	216		
North Fork	32	94	146	202		
East Fork	14	94	143	186		
Wildhorse	13	85	130	169		

[a]lncludes fish sampled from both mainstream and beaver ponds.

Table 3. Comparison of rainbow trout sizes at annulus from streams in the upper Big Lost River drainage.

Stream	N	Size at Annulus 1	2	3	4	5
West Fork	9	99	163	220	303	374
Muldoon	4	82	129	218	313[a]	
Lake Creek	1	105	146			
East Fork (upper)	90	147	189	220		
East Fork (lower)	8	91	142	196	258	349
North Fork	15	92	142	188	218	248
Summit Creek	4	117	164	230		
Fox Creek	4	89	129	190	226	
Twin Bridges Creek	12	89	132	186	243	

[a]Only one age 4+ fish in the sample (270 mm total length).

several other large rainbows, scales from this fish were not readable. Rainbows over 350 mm total length were captured from both the lower East Fork and West Fork. Rainbow trout from tributary reaches grow slowly and seldom reach five years of age.

Comparison of size at age of upper Big Lost River drainage rainbows with other populations would indicate that Big Lost River fish grow at a similar rate to fish from Henry's Fork tributaries, but slower than fish from the Henry's Fork or South Fork Boise River (Brostrom and Spateholts 1985; and Moore 1978).

Size at Maturity

Brook Trout

Brook trout matured at either age 2 or 3. The smallest mature fish observed was a 116 mm male. Mature females were occasionally observed in the 130 mm to 140 mm size range. Most fish of both sexes were mature if they had reached a size of 150 mm.

Rainbow Trout

Rainbow trout matured at sizes as small as 165 mm in tributary streams, but most mature fish were over 200 mm long. In main stem reaches, immature fish were often observed in the 200 mm to 250 mm size range, and it is probable that wild rainbows in these areas mature at three or four years of age at lengths of 250 mm to 300 mm.

Whitefish

Nearly every mountain whitefish longer than 250 mm checked during October on the main Big Lost River was mature. All of the whitefish less than 200 mm total length were juveniles.

Mortality Rates

Brook Trout

Brook trout mortality rates were calculated for eight stream areas with catch curves. Mortality rates in all areas indicate that very few fish survive to the end of their fourth year (Table 4). In most cases, sharp drops in cohort size occur between ages 2 and 3, but this was not observed in the West Fork (a main stem section) or on Cabin Creek (a spring-fed tributary). No mortality estimates were made for the upper East Fork (also a spring-fed system) because our sampling indicated a great number of age 3+ fish than age 2+ fish.

Table 4. Estimated mortality and survival rates for brook trout (ages 2-4) from tributaries to the Big Lost River.

Stream	Z	A	S	Comments
Summit Creek	1.30	.73	.27	
Lake Creek	1.59	.80	.20	
West Fork	1.47	.77	.23	
Cabin Creek	.73	.52	.48	
Muldoon Canyon	1.99	.86	.14	age 2-3 estimate
Muldoon Beaver Pond	1.18	.69	.31	
Upper North Fork	1.10	.67	.33	age 2-3 estimate

Rainbow Trout

Rainbow trout mortality was estimated for the lower North Fork, lower East Fork, and in Cabin Creek using catch curves. Rainbows in the lower North Fork had the highest mortality rate between ages 1 and 2 and ages 2 to 3 (Table 5). In the lower East Fork, mortality was highest from ages 3 to 4 and then leveled off at ages 4 to 5 (Table 5).

Cabin Creek was the only tributary section assessed. Mortality rates there are also highest from ages 3 to 4'(Table 3).

Tag Returns

Hatchery Fish

Anglers returned 162 regular tags and 45 reward tags from hatchery fish for a return rate of 6X and 15X, respectively. Using the assumption that all of the reward tags were reported, the estimate of creeled hatchery fish would be 5,249. Examination of the returns from each location stocked shows the highest rate of return coming from Kane Creek (25%) and the lowest from Lake Creek (5%) (Table 6). Overall, the return rate on reward tags was 2.5 times that of regular tags.

Hatchery fish were most likely to be caught during the initial five weeks following stocking, but fish were taken throughout the season, including fish stocked in June (Figure 15). During opening weekend, we checked several holdover fish which had been stocked during the previous year.

Wild Fish

Project personnel tagged 223 brook trout and 123 wild rainbow trout in the upper Big Lost River drainage during 1986. Of these, only four rainbows and three brook trout were recovered more than one week after being tagged (i.e., not part of a population estimate). Six of these fish were recaptured in the same location they had been captured. The remaining fish, a 259 mm mature rainbow trout, was tagged in Fox Creek just upstream from the irrigation diversion on May 9. It was subsequently recaptured by an angler during the general fishing season in the East Fork, indicating downstream movement of at least 1 km.

Angler Surveys - Catch and Effort

Anglers fished an estimated 29,133 hours (10,632 angler days) on surveyed sections of the upper Big Lost River drainage during 1986. Angler success was high with an overall catch rate of 1.33 trout per hour, ranging from 0.62 trout per hour on Wildhorse Creek to 2.37 trout per hour on Starhope Creek and the upper East Fork (Table 7). Hatchery

Table 5. Estimated mortality and survival rates for rainbow trout from the Big Lost River drainage.

Stream	Age	Z	A	S	Comments
Lower North Fork	(1-4)	.73	.52	.48	No fish over 260 mm long estimated
	(1-3)	1.07	.66	.34	
Cabin Creek	(1-4)	.82	.56	.44	
	(3-4)	1.54	.79	.21	
Lower East Fork	(2-4)	1.15	.68	.32	Survival higher on fish 4 yrs. and older
	(3-4)	1.32	.73	.2	

Table 6. Summary of tagged hatchery fish stocking and returns in the upper Big Lost drainage for 1986.

Stream	No. stocked		No. returns (% return)	
	Regular tags	Reward tags	Regular tags	Reward tags
North Fork	540	59	24 (4)	5 (8)
Main Big Lost	235	30	14 (6)	5 (17)
East Fork	845	80	58 (7)	14 (18)
Lake Creek	179	20	9 (5)	1 (5)
West Fork	351	41	15 (4)	4 (10)
Muldoon Creek	177	19	10 (11)	2 (11)
Wildhorse Creek	360	40	26 (7)	9 (23)
Kane Creek	180	20	6 (3)	5 (25)
	2867	309	162 (6)	45 (15)

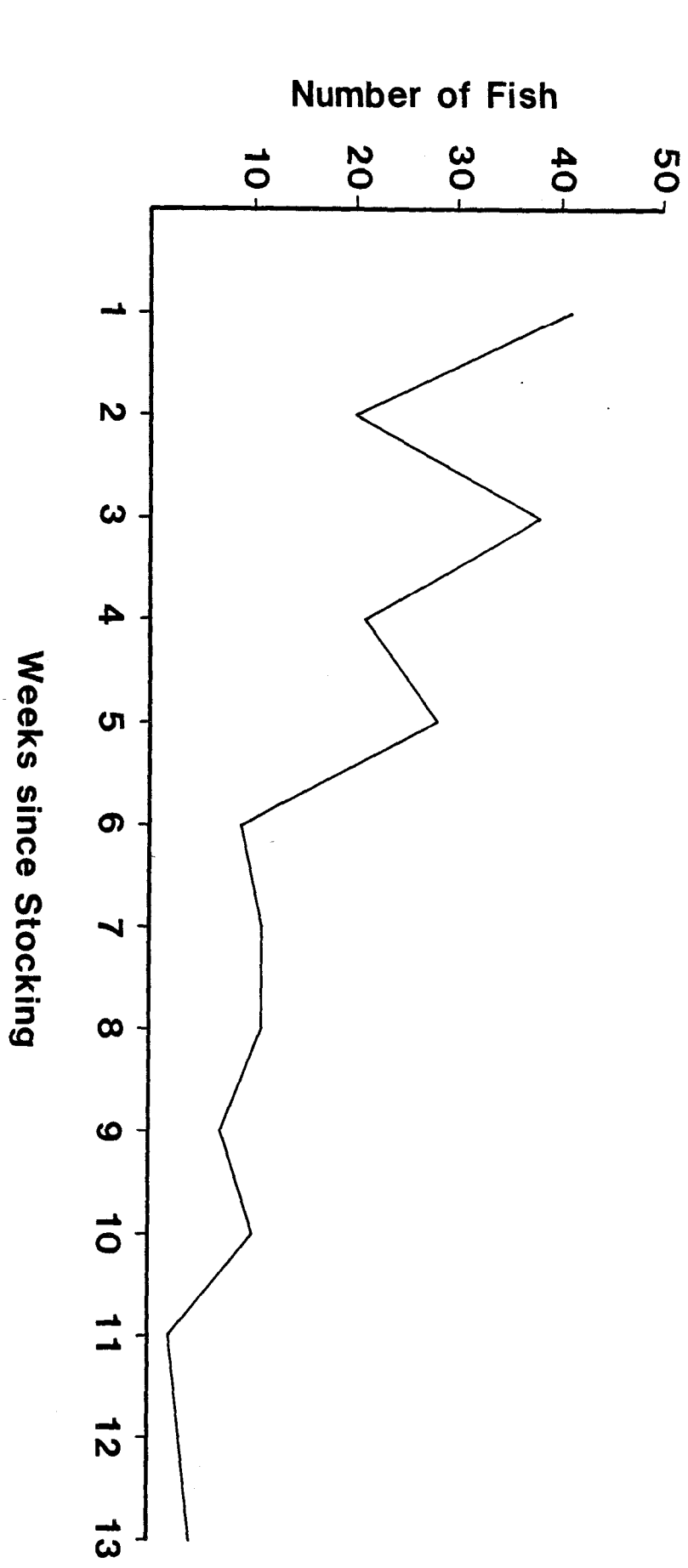

Figure 15. Timing of tag returns from hatchery fish stocked in waters of the upper Big Lost drainage.

Table 7. Summarized creel census data for surveyed portions of the upper Big Lost Drainage.

Creek	Hours Interviewed	Estimated Effort	Hours/ Ha	Catch Rate					Harvest Rate				Estimated Harvest			
				WRb	HRb	Brk	WF	Total	WRb	HRb	Brk	WF	WRb	HRb	Brk	WF
Star Hope	98.0	916.1	533.4	.12	1.49	.76	0.0	2.37	.01	.39	.15	0.0	9	357	137	0
Muldoon Canyon	63.5	1,266.8	264.0	.47	.46	.43	0.0	1.35	.30	.27	.20	0.0	380	342	253	0
Summit Creek	119.2	3,498.1	640.8	.12	.35	1.09	0.0	1.56	.05	.20	.34	0.0	176	704	1,203	0
Wildhorse Creek	225.3	5,562.1	631.6	<.01	.58	.05	.01	.63	<.01	.25	.04	0.0	25	1,382	198	0
Upper East Fork	466.6	5,725.9	894.7	.32	1.36	.69	.01	2.38	.13	.43	.31	.01	761	2,454	1,755	61
Lower East Fork	165.5	4,145.3	135.0	.21	.32	.10	.15	.77	.06	.18	.02	.05	250	751	100	225
North Fork	270.8	4,669.9	251.2	.06	1.12	.23	.07	1.47	.03	.56	.07	.01	138	2,638	328	52
Main Big Lost	114.5	1,547.2	35.1	.24	.61	.06	.24	1.16	.13	.26	.03	.21	203	405	41	324
West Fork	269.2	1,801.3	107.6	.09	1.18	.07	.04	1.39	.01	.81	.03	.02	13	1,452	60	1,531

rainbow trout comprised 61% of the trout caught and 63% of the harvest. Brook trout comprised 28% of the catch and 25% of the harvest, while wild rainbows contributed 12% of both the catch and harvest. Creel census estimates indicate that 30% of the hatchery rainbow stocked in the drainage are being harvested.

Length frequency data from angler creels show that anglers are unlikely to keep either hatchery or wild rainbow trout less than 200 mm long (Figure 16). The minimum acceptable size of brook trout was somewhat smaller at about 150 mm. Mean sizes of wild rainbow, hatchery rainbow, and brook trout in the creel were 268 mm, 260 mm, and 223 mm, respectively.

Whitefish also contributed to the fishery, primarily in the mainstem areas of the North Fork, East Fork, West Fork, and main Big Lost River. Overall, catch and harvest rates for whitefish were 0.05 and 0.03 fish per hour, respectively. No whitefish were caught by anglers in several tributaries, and the main Big Lost River supported the highest catch rate on whitefish at 0.29 fish per hour (Table 6).

Angler effort was concentrated primarily between the end of June and Labor Day (Table 8). Access to the drainage from the Ketchum-Sun Valley area was cut off on the Trail Creek Road by a snow drift which lasted until late June, and high water discouraged anglers from fishing during the same period. Following the Labor Day weekend, effort declined considerably. We were unable to locate any anglers during the final three weeks of the season.

Distribution of effort around the drainage varied widely (Table 7). Summit Creek, the upper East Fork, and Wildhorse Creek supported the highest intensity of effort with over 600 hours per hectare. Summit Creek, which does not receive hatchery fish, had a catch rate of 1.44 fish per hour compared with 0.63 fish per hour in Wildhorse Creek, which is stocked heavily. The upper East Fork, which is also stocked, maintains a catch rate of 1.01 wild trout per hour, which meets management goals. The main Big Lost River was the least intensively fished area receiving only 35.1 hours per hectare.

Angler Surveys - Questionnaire

Anglers from 20 counties and 15 states were interviewed during the survey. Residents comprised 85% of the anglers and came primarily from Bannock, Blaine, Bingham, Twin Falls, and Bonneville Counties (Table 9). Nearly 60% of the nonresidents were from California or Utah.

Based on 384 end-of-day interviews, anglers fished an average of 2.74 hours per day and creeled 1.5 fish per day. Approximately half of the anglers creeled no fish. Of those creeling fish, less than one-third creeled 4 or more fish (Appendix A). Most of the 645 anglers questioned fished with bait (59%), while lesser numbers used flies (30%) and lures (11%).

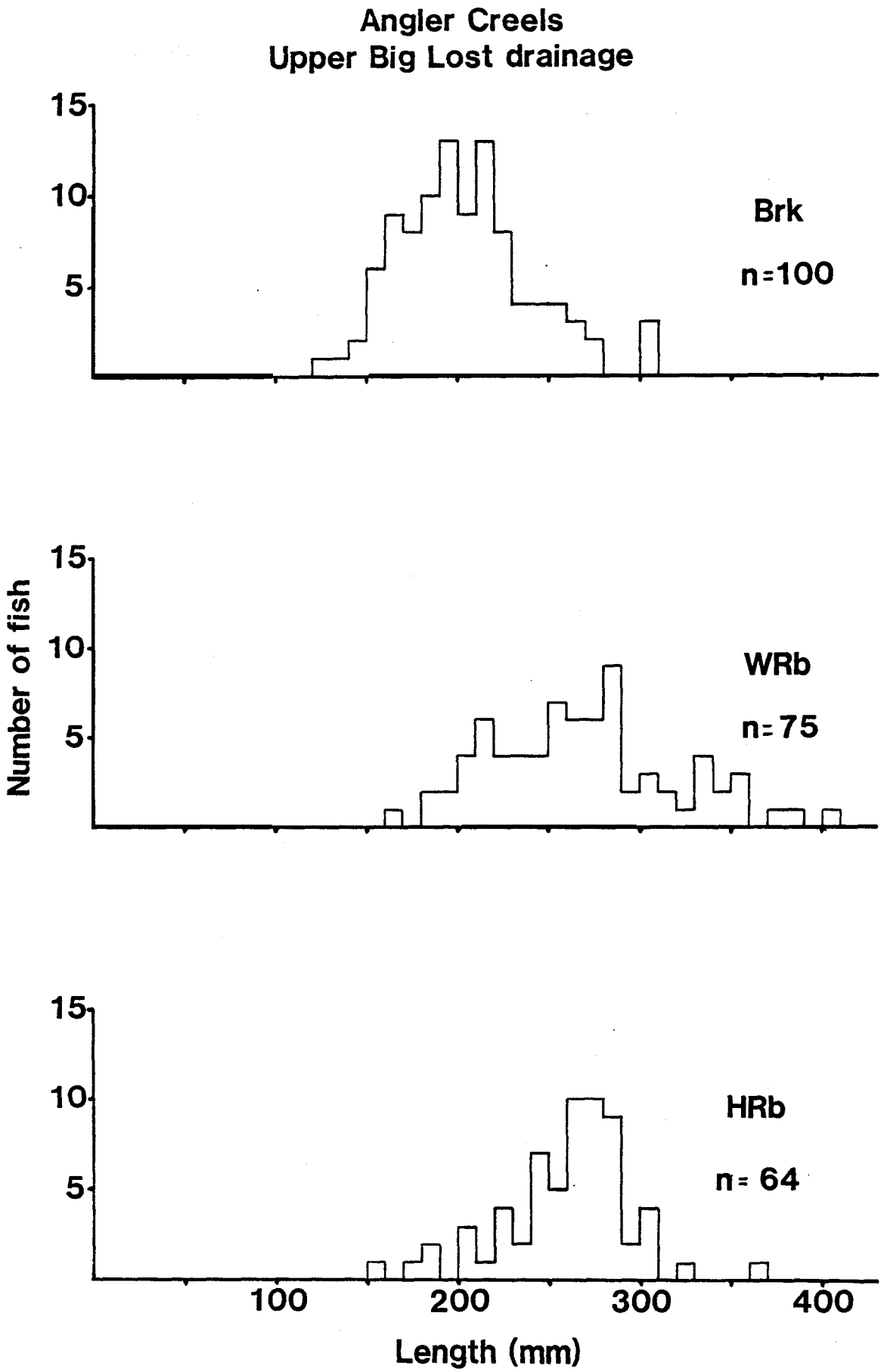

Figure 16. Length-frequency distributions of wild and hatchery rainbow and brook trout from angler creel census in the Upper Big Lost River.

Table 8. Timing of fishing effort expenditure by upper Big Lost anglers.

Date	Star Hope	Muldoon Creek	Wildhorse Creek	West Fork	North Fork	Summit Creek	Main Big Lost	E. Fork below W. Fork	E. Fork above W. Fork	Total
5/24-6/6	0.0	0.0	97.4	81.1	292.0	48.7	32.4	32.4	129.8	703.8
6/7-6/20	0.0	42.2	179.3	0.0	21.1	21.1	0.0	42.2	580.2	886.1
6/21-7/4	232.3	100.3	952.0	132.1	328.0	519.2	159.4	214.0	1,307.3	3,944.6
7/5-7/18	231.6	154.4	1,244.9	193.0	1,109.9	1,196.6	96.5	646.6	694.8	5,568.3
7/19-8/1	105.5	84.4	1,075.8	727.7	885.9	580.1	115.6	1,212.8	738.3	5,526.1
8/2-8/15	98.1	579.1	873.5	431.8	1,168.0	510.4	402.4	961.5	1,010.9	6,546.1
8/16-8/29	180.0	85.3	748.4	180.0	426.4	502.2	303.2	360.1	473.3	3,258.9
8/30-9/12	166.7	221.2	212.2	55.5	341.8	119.9	378.8	397.4	452.4	2,345.9
9/13-9/26	0.0	0.0	152.9	0.0	76.5	0.0	30.6	61.2	91.7	412.9
9/27-10/10	0.0	0.0	0.0	0.0	0.0	0.0	28.9	129.9	144.4	303.2
10/11-10/24	0.0	0.0	0.0	0.0	20.3	0.0	0.0	61.2	0.0	81.5
10/25-11/7	0.0	0.0	25.6	0.0	0.0	0.0	0.0	25.6	102.4	153.6
11/8-11/30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	916.1	1,266.8	3,498.1	5,562.1	5,725.9	4,145.3	4,669.9	1,547.2	1,801.3	29,132.7

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Table 9. Residence of anglers interviewed in the upper Big Lost River drainage.

Idaho Residents			Non-Resident	
County	Number	Percent	State	Number
8B	50	9.6	AZ	3
4C	16	3.1	OR	10
2T	51	9.8	UT	22
5B	101	19.4	MN	2
1B	114	21.9	CA	33
IF	6	1.2	WA	4
4B	71	13.6	WA D.C.	1
7C	28	5.4	CO	4
K	2	0.4	MT	3
V	1	0.2	NV	3
IA	29	5.6	FL	2
2J	14	2.7	KY	1
2M	14	2.7	IL	1
10B	15	2.9	NJ	1
1J	1	0.2	NE	1
E	1	0.2		
2C	3	0.6	Total	92
1G	1	0.2		(15%)
2P	2	0.4		
3C	1	0.2		
Total	521 (85%)			

We asked 392 anglers to rate the fishing in the upper Big Lost River. Seventy-four percent rated the fishing as good or excellent. When asked what the trend in fishing was, only 11Z said it had improved. About one-third of the anglers perceived the fishery as a declining one (Table 10).

A slight majority (58%) of the 402 anglers questioned indicated a preference for wild trout. Forty-one percent indicated that either wild or hatchery trout were acceptable, while 1% favored hatchery fish. Of the 235 anglers who said they preferred wild trout, 70% said they would favor the use of special regulations if it would improve wild trout populations.

DISCUSSION

Sport Fishery

Presently, the Big Lost River drainage provides a popular sport fishery. Anglers from all over Idaho and numerous other states fish the drainage. Catch rates have remained high and in most reaches exceed management plan goals (1 fish/hour), despite intense fishing pressure.

Hatchery introductions in the drainage have consistently exceeded 30,000 fish per year, and hatchery fish account for approximately two-thirds of the 1.5 fish per hour catch rates drainage-wide. Low returns in many of the smaller tributaries indicate low utilization of hatchery rainbows from some stocking sites, while other streams, such as the lower North Fork and Wildhorse Creek, have high returns and are dependent on stocked fish to maintain high catch rates. Thus, stocking levels could be reduced by half, and the management plan catch rate goal would still be met at a reduced cost (Appendix 2), provided that fish are distributed only in appropriate areas.

Many of the smaller streams are capable of maintaining high catch rates without requiring hatchery introductions. An example is Summit Creek, where stocking was discontinued after 1982. Summit Creek sustains the highest intensity of effort of any stream in the drainage (641 hours/ha), and yet maintains a catch rate of 1.4 fish per hour. Other tributary reaches, with the exception of Wildhorse Creek, are capable of sustaining catch rates at or near 1 fish per hour with wild fish. Wildhorse Creek is still recovering from a major flood in 1984 which severely damaged habitat, and probably seriously impacted fish populations. Depressed wild populations and a high return to the creel of hatchery fish in 1986 indicate that Wildhorse Creek should continue to be managed primarily as a put-and-take fishery. Should brook trout populations recover, hatchery plants could be phased out.

Table 10. Angler responses to opinion questions concerning fishing in the upper Big Lost drainage.

Rate Fishing:		
Excellent	52	13%
Good	240	61%
Fair	56	14%
Poor	44	11%
Total	392	
Trend:		
Improved	43	11%
Declined	121	32%
Save	131	35%
No Opinion	79	21%
Total	374	
Preference:		
Wild	235	58%
Hatchery	3	1%
No Preference	164	41%
Total	402	
Spec. Regs.:		
Yes	168	70%
No	73	30%
Total	241	

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The ability of the higher elevation small tributaries to maintain wild fish populations, despite intense pressure, is probably due to the small size at which brook trout mature. Since most brook trout are mature by the time they reach a size acceptable to anglers, harvest does not occur until after the fish have had a chance to reproduce. Brook trout are the most common species in the higher elevation reaches (Appendix 3). Mortality is high once fish reach the 150 mm to 200 mm size range, and probably due to both fishing and natural causes.

Larger streams at lower elevations, however, are primarily occupied by rainbow trout. Wild rainbows in the larger streams are capable of reaching large sizes (500 mm), but seldom do. Most rainbows probably do not mature until they are at least 250 mm long, yet are readily harvested by anglers by the time they reach 200 mm. High fishing pressure has resulted in low densities and low catch rates on wild rainbows, particularly in the lower North Fork and lower East Fork. High return rates of catchable rainbows from the North Fork make it a good section for a put-and-take fishery. However, the lower East Fork has lower returns but better habitat for wild fish. Thurow (Fishery Research Biologist, personal communication 1987) has observed an increase in the average size of rainbow trout in the Big Wood River as a result of special regulations. The Big Wood system is adjacent to the Big Lost and is similar in size and geology. Management of the lower East Fork rainbow trout population with special regulations would probably result in increased size and numbers of fish, and should be considered as a management alternative.

Many anglers in the upper Big Lost River are making their fishing trip a part of the recreation experience which includes camping, picnicking, or another activity (Appendix 4). The type of fish caught is less important to many anglers than whether or not a fish was caught. Only 58% of the anglers interviewed said they preferred catching a wild fish to a hatchery fish. I believe this is indicative of a less discriminating group of anglers than might be found on streams such as the Henry's Fork or Silver Creek, where fishing is probably the primary activity participated in, and wild fish are highly preferred. Nevertheless, a substantial segment of the angler population (70% of those who preferred wild fish) favored the use of special regulations to protect or enhance wild fish populations (i.e., at least 50% of the anglers interviewed). With depressed populations of wild rainbow in some main stem reaches, it appears that the opportunity to improve wild populations and satisfy one angler group without seriously encroaching on another, exists by zoning a main stem reach with special regulations. For instance, a special regulations reach on the lower East Fork would remove only about 10% of the total mileage of fishing streams in the entire upper Big Lost River drainage from general regulations. Further public input will be valuable in assessing public acceptance of such a concept.

Habitat

For the most part, fish habitat in streams of the upper Big Lost River is in good condition. Adequate bank cover, relatively stable stream banks, and good quality spawning gravels are found in at least part of almost every stream in the drainage. A notable exception to this is Twin Bridges Creek, located on both Salmon District Bureau of Land Management and private land. Heavy grazing on Twin Bridges Creek has resulted in severe damage to stream banks, loss of riparian vegetation, heavily-silted spawning gravels, and an overall reduction in available fish habitat.

Other areas, particularly private lands along the East Fork and some of the meadow areas on the upper East Fork, are somewhat impacted by cattle grazing. The Lost River District of the Challis National Forest is currently developing a riparian pasture program for public lands on the upper East Fork which should offset most of the impacts. Habitat on the private lands, although affected, is still capable of producing high numbers of fish.

Other stream habitat in the drainage, such as in Wildhorse Creek, has been affected by floods. Broad, shallow, flat water stretches in lower Wildhorse Creek, as well as the lower West Fork, would benefit from boulder placement to create scouring and surface disturbance. In some tributary reaches, placement of log structures would benefit fish populations. Assessments of log structures in Summit Creek suggest that they improve conditions for brook trout in steep gradient reaches. Densities in a section of Summit Creek with log structures were nearly twice as high as those in an adjacent section which had similar habitat but not structures. Slight increases in fish densities were also observed in the upper East Fork when log structures were placed in a grazed meadow section.

Beaver ponds also provide good habitat, particularly for brook trout in small streams. Brook trout tend to attain larger sizes in beaver ponds, and in some streams, beaver ponds support higher densities of fish than unimpounded sections. In addition, beaver ponds provide habitat on springs and side channels where no habitat would otherwise exist.

Habitat improvement opportunities exist on the upper Big Lost River, particularly on Forest Service lands. Presently, the Forest Service is able to obtain matching funds for habitat improvement projects through the Challenge-Grant Program. It should be possible for the Idaho Department of Fish and Game to cooperate with the Challis Forest, and possibly sportsmen's groups, to obtain funds to conduct habitat improvement projects. Key areas for habitat improvement projects on Forest Service lands include lower Wildhorse Creek, the lower West Fork, Starhope Creek near Starhope Campground, and portions of Muldoon Creek.

The key area on BLM land for habitat improvement would be lower Twin Bridges Creek. Alternative grazing practices on Twin Bridges Creek should be examined, and probably should include either a riparian pasture or exclosure strategy. Significant benefits to fish populations in this reach could be realized by allowing the riparian zone to recover. Riparian areas under private ownership would also benefit from a change in grazing practices. Efforts should be undertaken to work with private landholders to improve riparian areas.

Recommendations

1. Decrease numbers and locations of hatchery fish planted in order to use them more efficiently (see Appendix 3).

2. Work with land management agencies and private landowners to initiate and complete habitat improvement projects on areas where habitat is limiting the fishery.

3. Enhance populations of wild rainbow trout in main stem areas (specifically the East Fork) with special regulations to provide increased densities and average size.

4. Periodically monitor changes in the fishery resulting from management programs.

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A P P E N D I C E S

Appendix 1. General habitat description of streams in the upper Big Lost River drainage.

Stream	Reach	Length(km)	General Habitat Description
Big Lost River	Chilly Br. to North Fork	24.2	Shallow canyon, restricted channel, limited pool area, riffles and pocket water common, gradient 0.5%, some headcutting.
North Fork	Mouth to Summit Creek	5.8	Mostly restricted channel, limited pool area, riffles and pocket water common, gradient 0.7%, USFS priority rating' = 45 (entire North Fork).
North Fork Big Lost	Summit Creek to headwaters	24.5	Grazing damage, good riffle-pool ratio, some headcutting, gradient 0.8% except in extreme headwater areas where it is steeper. Some beaver activity.
Summit Creek	entire stream	15.8	Lower portion with constricted channel, good riffle-pool ratio which includes several drop leg structures, beaver activity, gradient 0.9-1.7%, USFS priority rating = 36.
Kane Creek	entire stream	10.6	Gradient 1.9-5.6%, limited pool areas, some grazing damage, USFS priority rating = 36.
East Fork Big Lost River	mouth to West Fork	20.3	Gradient 0.8%, some channel braiding, grazing damage in some areas, pool areas limited, good pocket water areas, USFS priority rating = 64.
Wildhorse Creek	entire stream	17.1	Gradients 0.8-2.6%, low gradient areas with good pool:riffle ratio, flood damage throughout-greatest near mouth, steepest areas with good pocket water areas and small pools, limited habitat near mouth, USFS priority rating = 55.

Appendix 1. General habitat description of streams in the upper Big Lost River drainage. (Cont.)

Stream	Reach	Length(km)	General Habitat Description
East Fork Big Lost River	West Fork to head-waters	16.1	Grazing damage considerable (1.2X) with meanders, droplog structures numerous, spring fed, overall habitat best in swamps reach. USFS priority rating = 64.
West Fork Big Lost River	mouth to Star Hope Point	2.3	Pool area limited, some grazing damage, mostly riffles with limited trout habitat present, gradient 0.8%, USFS priority rating = 64.
West Fork Big Lost River	Star Hope Point to Star Hope Creek	9.7	Habitat good to excellent with good pool:riffle ratio, riparian zone in excellent condition, some channel braiding. USFS priority rating = 64, gradient 0.7X.
Lake Creek	entire stream	11.3	Some grazing damage, beaver activity present, gradient 3.6X, pool:riffle ratio fair, good pocket water areas, overall habitat good.
Muldoon Creek	entire stream	13.5	Some grazing damage, beaver activity present, some flood damage, gradient 1.25X, good pool:riffle ratio, overall habitat good, USFS priority rating = 27.
Cabin Creek	entire stream	7.4	Spring fed, extensive aquatic growth providing excellent cover, limited grazing damage, habitat excellent, gradient 2.25%, USFS priority rating = 36.
Corral Creek	entire stream	9.3	Beaver activity present with numerous lare ponds, spring fed, severe grazing damage in some areas, gradient 2.3X, USFS priority rating = 36.

Appendix 1. General habitat description of streams in the upper Big Lost River drainage. (Cont.)

Stream	Reach	Length(km)	General Habitat Description
Twin Bridges Creek	entire stream	10.9	Severely overgrazed, bank sloughing common, siltation a problem, riparian zone damaged, gradient 2.0%.

[1] High USFS priority readings indicate that habitat is degraded. The scale is from 0 to 100.

Appendix 2. Upper Big Lost River Drainage User Survey, 1986.

1. Activities participated in:

	Number	Percent of Interviews
Fishing	62	80.5
Hunting	6	7.8
Camping	63	81.8
Hiking	25	32.5
Pinicking	8	10.4
Sightseeing/Photography	21	27.3
Off road vehicles	12	15.6
Horseback	1	1.3
Woodcutting	1	1.3
Scouting	1	1.3

2.

	Number	Percent of Interviews
Log structures fished?		
Yes	21	36.8
No	36	63.2
Improve fishing?		
Greatly	14	66.7
Moderately	6	28.6
Not at all	1	4.8

Appendix 2. Upper Big Lost River Drainage User Survey, 1986. (Cont.)

3. Management adequate?

	Yes	Percent of Interviews	No	Percent of Interviews
Grazing	36	76.6	11	23.4
Rip areas	27	71.0	3	29.0
Rec. sites	42	93.3	3	6.7
Roads	32	62.7	19	37.3
Trails	38	90.5	4	9.5
Logging	33	100.0	0	0.0
Mining	33	100.0	0	0.0
Fish	36	80.0	9	20.0
Wildlife	41	95.3	2	4.7
Others	Too many people			

4. Visit lakes?

Yes	22
No	47

Lakes visited.

Green	3
Round	3
Moose	1
Kane	5
Arrowhead	1
Big	4
Big Falls	2
Rough	1
Long	1
Goat	1

Total vehicles interviewed - 77
Total vehicles not interviewed - 106

Appendix 3. Recommended changes in the fish stocking program for the upper Big Lost River drainage.

Stream	Estimate effort (hrs/ha)	Catch rate (all fish)	I stocked (1986)	% return	Density of wild fish (M/100 m^2)	Recommended 1987 plant	Justification
Main Big Lost R.	35.1	.92	3,000	14	no data	1,000	Poor utilization
North Fork	251.2	1.40	6,006	44	0.1-26.6	4,000	Good populations of brook trout and lower utilization of HRb in upper reach
Wildhorse Creek	631.6	.63	4,011	34	0-5.8	4,000	Wild fish population low in lower reaches
Summit Creek	640.8	1.44	0	0	13.8-55.3	0	Brook trout sustaining fishery
Kane Creek	no data	--	2,004	35	no data	0	Most of returns from drifters to lower Summit Creek
West Fork/Starhope	135.7	1.61	7,011	26	0.5-3.8	2,000	Low utilization between Starhope Pt. and Starhope Creek.
Lake Creek	no data	--	2,004	5*	5.1-23.6	0	Low utilization, high density of wild fish
Muldoon Creek	264.0	1.35	2,004	17	2.7-20.9	0	Low utilization, high density of wild fish
East Fork	302.1	1.91	8,951	36	1.5-55.3	6,000	Low utilization upstream from Burma Rd. Wild populations capable of sustaining fishery.
Total			34,991	30		17,000	Fish can be better utilized in other areas

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Appendix 4. Number of anglers creeling different numbers of rainbow trout and brook trout from the Big Lost drainage based on end of day interviews of parties including 1 to 3 anglers.

	No. fish/angler*								
	0	.1-.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9	6.0-6.9	>7
All trout and char	107	16	29	17	16	7	7	15	3
Wild rainbow	190	12	11	2	0	1	1	0	0
Hatchery rainbow	141	16	21	14	8	5	2	7	3
Brook trout	168	13	17	7	4	2	5	0	1

*Numbers in columns do not total as an angler with multiple species would be included in multiple rows.

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